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BLASTOMYCOSIS

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A CASE of blastomycosis occurring in an unusual situation recently came under observation at the Royal Victoria Hospital, Montreal. It had been previously diagnosed as tuberculosis, and unsuccessfully treated as such; and this fact, as well as its unique situation, stimulated us to report it along with several other cases found in the hospital records, and to briefly review the literature.

There are two forms of this disease—the cutaneous and the systemic.

As a rule, the former begins as a papule or papulo-pustule which slowly enlarges. Most cases do not come under observation till they have attained a considerable size, *e.g.*, that of a twenty-five-cent piece or even larger, have ulcerated, and are discharging a serous or seropurulent secretion. The following are the chief characteristics of this form:

A patch of varying size projecting slightly above the surrounding skin and covered by irregular papilliform elevations, giving it somewhat the appearance of a cauliflower. This appearance is due to the presence of more or less bulky crusts which cover the surface of the lesion. On removal of these crusts the papules proper are seen; small, firm and comparatively dry in the younger lesions; large, lobulated and covered with a seropurulent secretion in the older or untreated lesions. The edges (see Case I, Fig. 1) are smooth, sloping, of a dull red color and sharply defined from the surrounding skin; on close observation they show numerous miliary abscesses. It is from these abscesses that the causative organism is best obtained in pure culture. A drop of pus when treated with 20 per cent. KOH and examined under high power reveals the organism as a double-contoured, vacuolated, yeast-like body which frequently shows budding forms. This latter condition is of

great diagnostic value, as it eliminates the possibility of confusing degenerated cells, fat globules, air bubbles, etc., with the organism proper. Media inoculated with this pus will show in the majority of instances a growth in from two to sixteen days, the appearance of which will vary greatly according to the medium used, the temperature and the amount of moisture present.

It has been suggested that these variations in appearance are due to the presence of more than one variety of blastomycetes. Viewed under the microscope, cultures show a mycelium with bud-like projections and also budding forms similar to those seen in pus. The mycelium formation does not occur in the tissues. Histologically, the most marked changes occur in the rete, which is the seat of an extensive hyperplasia, sending down irregular prolongations into the corium. The hyperplasia has been mistaken for epithelioma. These prolongations contain the miliary abscesses which are so characteristic of this disease.

The abscesses vary in size and are found in all parts, both superficial and deep, of the hyperplastic epithelium. They contain leucocytes, epithelial detritus, giant-cells of the Langhan's type and, most important of all, the organism peculiar to the disease is present in varying numbers and is easily overlooked. Too much emphasis cannot be laid on the presence of giant-cells. Although they are of the type usually seen in tuberculosis and have misled many into diagnosing the condition as such, they are in all probability " foreign-body " giant-cell formations, and closer examination will reveal the presence of the specific organism in their vicinity (Fig. 3). The histological picture may be summarized as a hyperplasia of the rete, the formation of miliary abscesses containing the organism and the presence of giant-cells. The most important fact in the etiology is that the disease is undoubtedly due to infection of the blastomycetes. Why certain yeasts should be pathogenic while others are not is still an unsolved problem. No predisposing causes have been recognized, but the following conditions have been noted in the cases reported, viz.: unfavorable hygienic surroundings; some debilitating systemic conditions (*e.g.*, diabetes, as in Case III); males are more often infected than females, probably owing to their more frequent exposure to infection; any age, but apparently more frequently met with between the fortieth and sixtieth years; and trauma.

We believe this latter factor to be of considerable importance and that the organism will not grow on the intact skin, some abrasion being necessary for infection to occur. In corroboration of this we note the history of trauma in all the cases reported in the hospital; and further,

in the study of actinomycosis at the Royal Victoria Hospital it was found that an abrasion was also necessary before infection could occur (*Jour. of Am. Med. Sc.*, June, 1913).

Clinically, the disease must not be confused with tuberculosis verrucosa. The following are the more important points of differentiation: the characteristic border and abscesses of blastomycosis of the skin, the results of histologic and bacteriologic examination, and the fact that the morbid condition improves under the influence of potassium iodide. Of lesser importance is the more frequent occurrence on the face and the more rapid development than lesions generally recognized as tuberculous. The constitutional symptoms of tuberculosis are also absent. Lupus vulgaris is distinguished by its characteristic nodules. Only the hyperplastic form of the disease could be confused with cutaneous blastomycosis. The differential features are practically those considered under tuberculosis verrucosa. In addition, tuberculosis verrucosa is a disease of early life while blastomycosis most frequently occurs after forty.

The disease may be confounded with syphilis, but other manifestations of this latter condition will usually be present. From carcinoma the disease can be differentiated by the soft base, by the multiplicity of the lesions, by the absence of glandular enlargement, and by the improvement and spontaneous healing shown under the influence of potassium iodide.

The surgical treatment consists in removal *en masse* where possible and this is probably the most effective method of cure. If this is impossible curetting may be tried, but it is not a certain preventative of the return of the malady. Medicinally, potassium iodide appears to be almost a specific and should be given in large doses. It does not appear to act directly on the organism but stimulates the tissues to ward off the disease. A combined surgical and medical treatment is frequently employed. X-rays have been recommended, but in Case IV of our series, which at first was diagnosed as lupus and treated as such by X-rays, the condition seemed only to be aggravated. The prognosis is generally favorable unless complicated by some intercurrent infection.

Following are detailed reports of four of the six cases occurring in the hospital records. Case III is of particular interest, as it shows the liability of the disease to become general.

Case I.—A. V., age forty-eight; Italian laborer. One year ago patient first noticed a hard swelling just posterior to anus, about the size of a hazel-nut. This was opened with a pin and a small amount of blood-stained fluid escaped. Shortly after this hard

mass ulcerated, the ulcer gradually increasing in size. This condition was diagnosed as a tuberculous ulcer and curetted. The glands in the inguinal region became involved and broke down, discharging pus. Examination showed an ulcerated area just posterior to anus (see Fig. 1), extending backward in anal cleft, 1½ inches by 1½ inches. The surface of the ulcer was bright red in color, with granular appearance. The edge was raised and seemed to be composed of numerous small papillomas (Fig. 1).

Treatment.—Curetting of ulcer; plus potassium iodide, grs. 30, t.i.d.

Result.—Improving.

Pathological Report.—Pus from inguinal region showed typical double-contoured organisms. Sections of tissue revealed marked epithelial hyperplasia, numerous small collections of polymorphonuclear leucocytes and numerous giant-cells of Langhan's type (Fig. 2), while here and there, particularly near the giant-cells or in the abscesses, the organism was seen (Fig. 3).

CASE II.—J. O.; age sixty-three; farmer. Seven weeks previous to admission to hospital, while passing through woods, received a small scratch over malar eminence by a branch. A scab formed over the abrasion under which a small quantity of pus escaped. On entrance to the hospital the ulcer was the size of a twenty-five cent piece and covered with a thick scab, had a rather punched out appearance, and the skin surrounding was reddened and thickened. Submaxillary glands enlarged.

Treatment.—Excision of ulcer, plus potassium iodide, grs. 30, t.i.d.

Result.—Cured.

Pathological Report of Tissue.—Sections showed marked hyperplasia of the epithelium, owing to downgrowth of lower layers. In places atypical pearl formation was noted. Small abscesses were numerous in the epithelial downgrowths, while throughout the section giant-cells of the Langhan's type were seen. Later definite and typical blastomycetes found.

CASE III.—Italian; age forty-three; laborer. Admitted April 3, 1910. Died June 14, 1910.

Complaints.—Sore right eye.

Trouble began about middle of September, 1909, when he first noticed a small pimple about the size of a split pea on the outer side of the external canthus of the right eye. It was slightly tender and gradually increased in size till early in December, 1909, when it broke down and began discharging a small quantity of blood-stained, thin material. This continued till the present. There has been a certain amount of surrounding œdema since January 1, 1910. He does not complain of pain but of tenderness. Has had

FIG. 1.—Case I. Shows ulceration posterior to anal orifice. Note raised edges and papillary appearance.

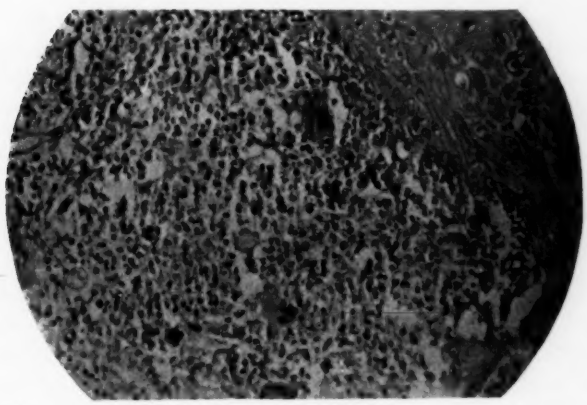

FIG. 2.—Showing organisms in granulation tissue.

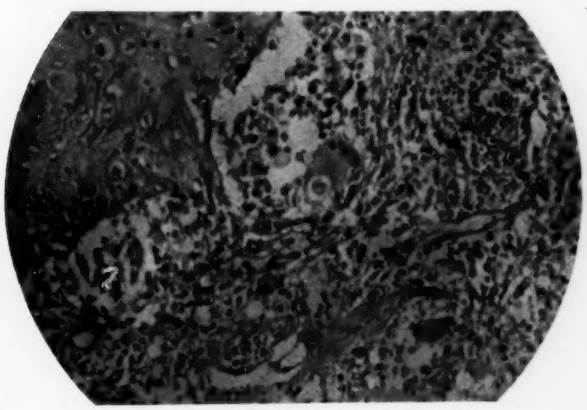

FIG. 3.—Organism situated near giant-cell. Note proliferation of epithelium and atypical pearl formation.

occasional headaches. Has always been a healthy man and denies venereal trouble. No history of injury could be obtained. Family history negative.

Present Condition.—Fairly well-developed and well-nourished man. Pale, not complaining of pain but of tenderness around sore—and of headaches. Over the right temporal region extending from temporal ridge downward, including outer third of right eye over to the malar prominence, is a diffuse swelling, very slightly discolored and tender. Point of maximum tenderness is just over temporal region, 1½ inches behind the outer canthus, and on a somewhat higher level. There is a small discharging sinus close to the temporal side of the outer canthus; the edges are red, slightly swollen, and fresh masses of granulation tissue discharging a small quantity of a sero-mucopurulent material are seen. An ordinary-sized probe could be passed upward and backward a distance of 1¾ inches. Respiratory, circulatory, and genito-urinary systems normal. Urine: amber, clear, acid; 1022; no albumen, no sugar, no casts.

Treatment.—Potassium iodide, grs. 30, t.i.d.

Diary.—April 11, incision made over right temporal region down to bone. Peculiar condition found in bone. Small piece kept for examination. Cut surface of bone did not bleed much. Sinus was curetted and discolored tissue removed; wound packed with iodoform gauze. April 16, complained of bad headaches, very restless; same on April 17. April 20, dressed, no discharge, wound granulating up. April 27, slight chill, no rise in temperature. May 15, smears taken of pus in eye (?) showed many typical blastomycetes (Drs. Keenan and McKenty). June 1, sinking fast, taking no nourishment, dull, sleeping most of the time. Died June 14.

Diagnosis.—Blastomycosis infection.

Post-mortem Examination Four and a Half Hours After Death.—Mycosis of widespread type; caries of frontal bone with suppuration; suppuration of ethmoidal sinus, sphenoidal sinus, and superior nasal meatus; caries of right temporal bone; basal suppurative meningitis; internal hydrocephalus; retropharyngeal abscess; disseminated suppurative foci in lungs; old scars on extremities; pleural adhesions; chronic pericarditis; atheroma of aorta (slight); fatty degeneration of liver; nodules in spleen; retention cysts in kidney; congestion of small and large intestine; purpuric hemorrhages of skin.

NOTANDA.—The case has been previously classed among the blastomycoses and is of very remarkable nature, first, owing to the rarity of generalization of disease in infections of this kind; second, owing to the nature of the bone lesion. The steadily pro-

gressive carious change which took place and the extension of disease by actual continuity from the forehead through the orbital plate to the various cells at the root of the nose, with secondary infection of the meninges on the one hand and partial involvement of the orbit on the other, and the spread shown finally into the retropharyngeal tissue, are all worthy of great note and full of interest. The organism at work was a spherical body with well-defined capsule and chromatic granules in its interior. It multiplied by fission, one individual producing two others or more. A culture which was at the time successful showed a growth which was definitely mycelial, so that it shows an alternation of generation accounting for its encysted form in this case. It is probable that the lung condition was due to aspiration, since there were no secondary deposits elsewhere. The nodules in the spleen are apparently of a different nature. (O. C. Gruner, Path. Dept., R. V. H.).

CASE IV.—Mrs. D.; age thirty-two; farmer's wife.

Complaints.—Growth on nose.

History of Present Illness.—Two months previous to entrance to hospital a small pimple appeared on tip of nose which gradually increased in size; around the edge other similar ones appeared and these gradually coalesced until the whole lower half of the nose was involved. The ulcerated area has a peculiar warty appearance. The edges fade gradually into the surrounding skin in places, while in other areas the edge is heaped up and of dark brownish color. On the surface of the ulcer numerous papilliform growths were noted, in the centre of which small drops of pus can be extruded. In the older parts of the growth these papilliform projections become more closely applied and were covered with thick dark scabs which, on removal, revealed a small ulcerated surface. These crusts are often very adherent. The glands of the neck are not involved. Personal history negative.

Family History.—Several relatives died of tuberculosis.

Treatment.—At first the condition was looked upon as lupus, and treated with X-rays, which seemed to increase the rapidity of the growth, as after the beginning of treatment the disease spread very rapidly. Later examination of pus revealed the organism. Afterwards this patient was put on iodides and she immediately showed signs of improvement.

THE OPERATIVE TREATMENT OF ARTERIAL THROMBOSIS AND EMBOLISM*

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Our interest in the subject which forms the title of this paper has been aroused principally by the study of three cases in which efforts have been made to relieve arterial obstruction by surgical means. Two of these cases, in which the femoral artery was concerned, were reported in full to the Philadelphia Academy of Surgery in May, 1907, and are here reproduced in abstract. The third case, one of embolism of the abdominal aorta, is now published for the first time.

The operative methods that have been proposed for dealing with thrombosis and embolism of the arteries are (1) ligation, (2) arteriovenous anastomosis, (3) arteriotomy, (4) arterial resection, (5) arterial catheterization.

1. *Ligation* of the affected artery, distal to the point of obstruction, has been suggested in order to prevent the detachment of emboli. Whether this suggestion should be adopted or not depends, to a large extent, upon the frequency with which emboli are liberated from the point of obstruction, upon the damage that such emboli may produce after they are set free, and upon the possibility of recognizing an intra-arterial clot when it is most likely to launch particles into the blood stream.

The constant attrition of a strong current of blood on a growing mural thrombus is surely conducive to fragmentation of the more recently formed layers of that thrombus, and it is our belief that minute particles of blood clot, which are, however, too small to cause mischief unless laden with bacteria, are always washed from a non-occluding thrombus and from an occluding thrombus that has reached the parent stem of the vessel in which it lies. The process is a microscopic, symptomless embolism, and it accompanies the healing of all wounds involving blood-vessels, hence may be regarded as a normal phenomenon of repair.

In contradistinction to this physiologic embolism, pathologic embolism from a developing arterial thrombus or an arrested embolus

* Annual oration, read before the Philadelphia Academy of Surgery, January 4, 1915.

is rare, at least so far as can be estimated from a clinical study of the subject. One of the reasons for this rarity is that the separated clot must be of a proper size to cause symptoms. If it is of microscopic dimensions and aseptic it is incompetent to work harm. If it is of great size, almost as large as the original clot, it becomes impacted immediately distal to the original clot and not in one of the branches of the affected vessel. Despite the greater blood-pressure in the arteries, which fact might lead to the inference that an intra-arterial clot would be more liable to suffer disintegration and dispersion than a clot in a vein, arterial thrombosis is decidedly less apt to result in harmful embolism than venous thrombosis. Owing to the composition of the arterial blood, a thrombus in an artery forms more slowly than one in a vein, hence is firmer in consistency. The walls of an artery are thicker than those of a vein, consequently a thrombus in an artery is less liable to be displaced by pressure from without. The arteries diminish in size in the direction of the blood current, as a result an occluding thrombus in an artery cannot be driven farther; whereas in a vein, which increases in calibre in the direction of the blood current, a thrombus may be washed *en masse* from its moorings.

Even though observation leads to the conclusion that emboli of proper size to cause trouble seldom arise from an intra-arterial clot, if the damage to the tissues deprived of blood by such emboli were great, ligation might still be urged to avert that damage. A small clot floating from a partly occluded artery is not likely to inflict more harm than total occlusion of that artery by ligation, whether the artery be the aorta, the brachial, the femoral, or the carotid. A small clot freeing itself from a mural thrombus which later becomes occlusive might, however, seriously interfere with the development of a collateral circulation, and the same result might be caused by a small clot thrown from an occlusive thrombus.

Even with the possibilities just mentioned in mind, however, ligation cannot, as a rule, be recommended, because the greatest danger of detachment of emboli is when the thrombus is forming, in other words, when the diagnosis of thrombosis cannot be made. When the diagnosis is certain, the thrombus is occlusive, and the danger of embolism is probably passed. Small particles can no longer be driven from the clot, and it cannot be displaced *en bloc,* because the vessel beyond is smaller than the thrombus.

2. *Arteriovenous anastomosis,* above the point of arterial obstruction, in order to induce the arterial blood to flow through the veins towards the periphery, and so reach the undernourished tissues, is an

operation which has enthusiastic advocates and strong opponents. Probably most surgeons are in a state of indecision as to the merits of this procedure. According to some experimenters, reversal of the circulation in the veins is impossible, owing to the resistance offered by the valves. Other experimenters, notably Carrell, have succeeded by arteriovenous anastomosis in filling the veins with red blood. None has demonstrated, however, that this red blood passes through the capillaries before returning to the heart.

It is probable that with time the valves might be forced to yield to the constant bombardment of the blood diverted from an artery into a vein, and that, aside from actual tearing or stretching of the valves, they might easily be rendered incompetent by the dilatation of the vein in obedience to the increased intravenous pressure. In either event, however, the time would have to be brief if the part threatened with gangrene is to survive, and the constant hurling of the blood against the valves with the consequent eddies in the stream would surely predispose to thrombosis, especially if the valves were lacerated, instead of simply bent back or separated. In addition to these theoretic considerations we have undisputed clinical evidence that in certain cases of varix and arteriovenous aneurism the blood flows centrifugally in the vein.

Reversal of the circulation in the capillaries and arteries, however, would seem to be possible only in an organ with a terminal circulation. If the veins, as is the case in the extremities, have numerous anastomotic branches, the arterial blood diverted to the principal vein will always seek these branches, and return to the heart in collateral venous channels, in which the pressure is feeble, rather than overcome the greater resistance of the capillaries and thus reach the arteries. Here again, *i.e.*, in the arteries, the presence of anastomotic branches, if functionating, would offer an insurmountable obstacle to a centripetal flow of blood from the capillaries, since the red blood in these anastomotic branches would quickly distend the main artery, below the site of the artificial arteriovenous junction, with greater force than that of the dark blood accumulating from the capillaries. This dark blood, even if regurgitated into arterioles without anastomotic branches, would, in most instances, only hasten their obliteration by thrombosis, since, in addition to the coagulative tendency of used blood, the arteries would be, in most instances, badly diseased and, owing to the fall of blood-pressure consequent upon their assumption of the function of veins, much reduced in calibre.

It is probable that in most of the cases of arteriovenous anastomosis

for threatened gangrene in which the results are reported as favorable the operation was a failure, *i.e.*, that thrombosis occluded the vein and the artery at the site of anastomosis, and that the amelioration noted in the symptoms was due, not to increased blood supply, but to interference with the venous drainage. This probability is supported clinically by those cases of Raynaud's disease temporarily benefited by the application of elastic constriction to the base of the limb, and also by von Oppel's experience in securing, by means of ligation of the popliteal vein, a return of warmth, color and sensation in a leg menaced by gangrene. If the arteriovenous fistula remains patent the chances are, unless our theories are entirely wrong, that the blood shunted from the artery to the veins does no more than hinder the return of blood in those veins, thus contributing to passive hyperæmia. Another explanation, applicable to a few of the " successes " in preventing gangrene, especially in the upper extremities, is that, owing to an adequate collateral circulation, gangrene would not have occurred without operation.

If the collateral circulation is adequate, and the anastomosis is made immediately above the point of arterial obstruction, the only harm that could be done, aside from the evil possibilities attending all operations, is obliteration of the vein by thrombosis, and perhaps this might prove, as pointed out above, beneficial rather than injurious. If, however, the collateral arterial circulation is not competent to irrigate the limb, and there is still some blood passing through the artery, or if functionating arterial branches exist between the point of obstruction and the anastomoses, failure of the operation, *i.e.*, thrombosis, would increase the danger of gangrene.

Since 1902, when San Martin reported the first case, arteriovenous anastomosis for restoring the circulation has been done about 70 times: Once between the carotid and the internal jugular, twice between the brachial vessels, four times between the popliteal vessels, once between the anterior tibial artery and the internal saphenous vein, and the rest between the femoral vessels. The indications were hemiplegia, probably embolic, in one case; embolism in two cases; traumatic destruction of the vessels (excision for sarcoma and aneurism, gunshot wound, rupture of the vessels from lightning stroke, crushing accident) in five cases; and to prevent or to limit arteriosclerotic gangrene (including Raynaud's disease) in the remaining cases. In about 20 per cent. of these cases the results are said to have been satisfactory. Most of these apparent " successes " are seriously questioned by unprejudiced observers, and it is highly probable that the operation is never successful

in so far as reversing the circulation is concerned, but that improvement in the symptoms, at least, temporary, occurs in a few instances there can be no doubt.

In view of this fact, and despite the theoretic objections to arteriovenous anastomosis, it cannot be condemned utterly. It may be that circumstances occasionally will arise under which the conscientious surgeon, forced to a decision between this operation and eventual amputation, will be willing, after laying the experimental nature of the proceeding before the patient, to perform an arteriovenous anastomosis, in the hope that he may do no harm and possibly may effect some good. It may be, too, that future experimental or clinical evidence will force us to alter our views of this operation.

If arteriovenous anastomosis is decided upon, the method to be employed should receive serious consideration. The method which is physiologically ideal, so far as the effort to obtain complete reversal of the circulation in the vein and the artery is concerned, consists in severing the artery and the vein and then uniting, end-to-end, the central segment of the artery to the distal segment of the vein, and the distal segment of the artery to the central segment of the vein. There are, aside from its technical difficulties, three important objections that may be lodged against this procedure. The vessels are crossed at the point of suture and exert pressure on each other, thus retarding the flow of blood through the anastomoses and predisposing to thrombosis. If the artery below the point of anastomosis is patent and its connections with collateral arteries undisturbed, part of the blood from these collateral branches will stream up the artery and into the vein, and thus be diverted from the capillaries where it is so greatly needed. If thrombosis occurs at the point where the peripheral arterial segment is joined to the proximal venous segment, a portion or the whole of the thrombus may be driven or drawn into the vein and be carried to the pulmonary artery or one of its branches. These objections may be overcome by sacrificing the physiologic ideal and tying the peripheral end of the artery and the proximal end of the vein, trusting that the blood which is driven into the distal segment of the vein may find its way back to the heart through collateral venous channels. The same result, *i.e.*, shunting the arterial blood into the vein and forcing the blood to seek channels other than those of the main artery and vein in its journey back to the heart, may be obtained by performing lateral anastomosis and then tying the vein proximal and the artery distal to the anastomosis, by implantation of the upper end of the artery into the side of the vein, with ligation of the vein above the anastomosis and

ligation of the distal arterial segment, or by implantation of the lower end of the vein into the side of the artery, with ligation of the artery below the anastomosis and ligation of the proximal venous segment. All of these substitutes for end-to-end anastomosis deflect and deform the blood stream as it passes from the artery to the vein, which irregularities in direction and form are important factors in coagulation. Further, these substitutes all lack the advantage of smoothness in the neighborhood of the anastomosis, the first leaving two pockets, and the second and the third each leaving one pocket, in which a propagating thrombus is likely to develop. Without ligation as described above, lateral anastomosis and lateral implantation of artery into vein short circuit the blood that finds its way into the vein, it being easier for this blood to follow the normal direction of the venous current than to flow towards the periphery. Lateral implantation of vein into artery, without ligation of the artery distal to the anastomosis, and lateral anastomosis with ligation of the vein proximal to the anastomosis, may seem to possess some elements of innocuousness, in that while part of the blood is diverted to the vein the circulation in the artery is not suppressed, thus permitting it to carry nourishment as far as it is patent. This plan for dividing the arterial current is a compromise between a frank effort to reverse the circulation and "watchful waiting," and is less likely to succeed than either. It predisposes to thrombosis in the artery because of the decrease in intra-arterial pressure consequent upon the leak at the site of anastomosis, and because of the decrease in intra-arterial pressure the blood which passes through the artery is less apt to permeate the capillaries. Further, the amount and the force of the blood diverted to the vein are necessarily less than when the whole arterial stream is directed into the vein, and the blood so diverted, instead of penetrating to the venous radicals, escapes into the returning collateral veins through the first anastomotic branches, unless in the meantime it solidifies into a thrombus.

3. *Arteriotomy,* for the purpose of removing an embolus, was attempted first by Sabanajew in 1896. The embolus, which was supposed to be in the femoral artery, was not found, however, and the limb was amputated at a lower level.

The first report of a successful embolectomy was made by the author to this Academy in May, 1907.

A man, aged sixty-one years, was suddenly stricken with excruciating pains in the right foot, followed by gangrene of the foot and the lower two-thirds of the leg. Pulsation could not be felt in any of the vessels below the bifurcation of the femoral. Thirty-six hours after the onset of the pain the femoral artery

was opened, the embolus extracted, and the artery sutured. Pulsation immediately reappeared in the femoral below and in the popliteal, but not in the tibial vessels, and this pulsation continued for eight days. The gangrene did not extend after operation. Forty-two days later the leg was amputated below the tubercle of the tibia. About 15 ligatures were necessary and the bone bled freely on section. The popliteal artery contained a small clot, and a probe passed up into the artery for several inches caused a slight flow of blood.

In 1907 three additional arteriotomies for embolism were reported. DOBERAUER opened the right axillary artery and removed an embolus 52 hours after its impaction. Thrombosis occurred within a few hours and the artery was again opened and the clot extracted. The thrombus reformed and two days later an anastomosis was made between the artery and the vein, whereupon the gangrene ceased to spread.

HANDLEY attempted to aspirate and to wash an embolus from the left common iliac artery, 12 hours after its impaction, by passing a catheter through the deep femoral, the common femoral, and the external iliac. He succeeded in inducing a pulsating flow of red blood, but death occurred 24 hours later.

MOYNIHAN removed an embolus that had lodged in the popliteal artery; the patient died four days later. The condition of the leg after the operation was not mentioned.

Arteriotomy for embolism of the pulmonary artery, which was suggested by Trendelenburg in November, 1907, and which has thus far always been followed by death, we have excluded from our discussion, as the pulmonary artery belongs physiologically to the venous side of the circulatory apparatus.

In 1909 MURPHY incised the femoral artery four days after the onset of acute ischæmia in the left lower limb, and dislodged an embolus from the common iliac by fragmentation, using a catheter and forceps. The lower limb was already gangrenous, and amputation was performed four days after the arteriotomy.

In the same year SCHIASSI extracted an embolus from the femoral artery, and amputated through the thigh four days later.

In 1911 two cases appeared in the literature. PROUST removed an embolus from the femoral artery 12 hours after its impaction. The patient died the following day.

MOSNY and DUMONT removed an embolus from the left femoral artery six hours after the onset of symptoms. The limb did not become gangrenous.

In 1913 three new cases were brought to light. KEY'S patient complained of sudden, violent pain in the left popliteal space, with coldness and numbness in the leg. Seven hours later the dorsalis pedis was exposed by incision and found to be empty; next the popliteal artery was laid bare and it too was found to be empty. Then the femoral was uncovered, opened, and an embolus removed. The wounds healed kindly and gangrene did not follow, although, probably as the result of ischæmia, there was slight paralysis of the peroneal muscles and some contraction of the muscles of the calf.

In MATTI'S case likewise, the symptoms were referable to the foot and leg, although no arterial pulsation could be obtained lower than a point 3 cm. below

Poupart's ligament. Thirteen hours after the trouble began the femoral artery was incised near its bifurcation, and a clot 3 cm. long withdrawn from the superficial femoral, and one 2 cm. long from the deep femoral. Later, owing to absence of bleeding from the lower part of the superficial femoral, this vessel was milked from below upward, and a clot 15 cm. long forced out through the wound. This was followed by copious bleeding and the artery was then sutured. After several days thrombosis recurred in the superficial femoral artery. The gangrene was limited to the toes, the superficial parts of the heel, and a narrow area of skin along the inner surface of the leg. The patient died two months after operation from cardiac disease and pneumonia.

BAUER'S case we give in detail because it is the first, and, indeed, with the exception of our own, the only one in which the abdominal aorta was opened to remove an embolus. The patient was a man, aged thirty-nine years, suffering from chronic articular rheumatism and mitral disease. Suddenly severe pain was experienced in both legs, which became useless, and in the lower abdomen. The pulse was irregular and the face cyanotic. Over both lower limbs, and over the abdomen as far as the umbilicus, the skin was cold and livid. No pulse could be felt in the femoral arteries. Sensation was abolished in the feet and the legs, and only partly present in the thighs and over the lower abdomen. Operation was performed three hours after the onset of the embolic symptoms. An incision was made in the linea alba, the small intestine drawn from the abdomen and laid on the right side of the abdominal wall, the posterior parietal peritoneum incised, and the aorta isolated. After the aorta had been compressed by the finger of an assistant an incision 2 cm. long was made into the artery just above its bifurcation, and the embolus extracted. The arterial wound was then closed with six sutures of silk. Pulsation was immediately felt in both iliac arteries. The operation lasted one hour and forty minutes. The embolus was about 3 cm. long and had the form of a molar tooth with two short roots; the "crown" lay in the aorta, the "roots" in the iliac arteries. Symptoms referable to the lower limbs promptly disappeared, except for some pain in the left foot and calf. The patient left his bed on the twenty-fifth day and was discharged on the thirty-second.

The history of our case of aortic embolectomy, hitherto unpublished, is as follows:

S. A., female, aged forty-nine years, had always been in good health up until a few years before admission to the Jefferson Hospital, when, following an attack of acute articular rheumatism, she began to suffer from dyspnœa. About three weeks before operation she was compelled to go to bed because of dizziness, cough, weariness, and severe headache. One week after this she suddenly lost her voice, and, although not unconscious, seemed unable to comprehend what was said to her. A few days later it was noticed that she frequently rubbed both legs and especially the right one, which quickly became dark in color. At the time of entering the hospital the patient was restless and constantly moaning. The voice had partly returned, but only a few words could be uttered distinctly. The pupils were small, equal, and

reacted to light. There was no paralysis of the tongue or face, no jaundice, and no enlarged lymph-glands. The tongue was heavily coated, the thyroid gland distinctly palpable. There was slight impairment of resonance and increased harshness of the breath sounds over the apex of the right lung. The heart was enlarged and very irregular in action, the apex beat diffuse, feeble, and in the sixth interspace, about 13 cm. from the median line. Over this point a presystolic thrill and murmur were present. The radial arteries were slightly atheromatous. No abnormalities were discovered in the abdomen. Pulsation of the abdominal aorta could be made out by palpation. Pulsation could not be felt in the external iliacs, or in any of the arteries in the lower limbs. The right foot was black and shrivelled, the lower two-thirds of the right leg purplish, with loosening of the epidermis and bleb formation. The left leg was painful, tender, useless, warm (because of the presence of external heat), and pale, except over an indurated area, about two inches in diameter, just external to the middle of the tibia, where the skin was reddened and œdematous. The urine showed a trace of albumin but no casts, the blood a negative Wassermann reaction and 21,600 leucocytes (polymorphonuclears 84 per cent., hyaline 5 per cent., lymphocytes 10 per cent., eosinophiles 1 per cent.). There was no fever.

In view of the advanced and extending gangrene in the right leg, with only prodromal symptoms of gangrene in the left leg, it was thought that an embolus had lodged in the right femoral artery sometime preceding the impaction of a second embolus at the bifurcation of the aorta, or that an embolus had been arrested at the bifurcation of the aorta, which embolus had completely occluded the right iliac artery and at first only partly occluded the left iliac artery, the obstruction of the latter vessel becoming complete at a more recent period as the result of a superadded thrombus proceeding from the embolus. As no induration could be felt along the right femoral artery the second explanation seemed to be the better, and indeed proved to be the correct one. The red indurated area in the left leg was considered to be due to a small embolus from the heart, or from the clot accumulating at the origin of the left common iliac artery.

Although, by reason of the feeble action of the heart, it was recognized that an effort to clear the aorta would be attended by great risk, it was deemed imperative to make the attempt, not only for the purpose of saving the right thigh and the left lower extremity, but also for the purpose of relieving the cardiac embarrassment that always accompanies aortic obstruction. The alternative was abstention, gangrene of both lower limbs, and death.

The operation was performed January 5, 1914, under ether,

administered by intratracheal insufflation. The abdomen was opened in the median line below the umbilicus, the small intestine segregated in the right side of the abdomen, and the sigmoid pressed to the left. The iliacs were motionless; the aorta pulsated to a point near the bifurcation, at which point it was hard. The posterior parietal peritoneum was incised, and a silk ligature passed beneath the aorta at a point one and one-half inches above the bifurcation. This ligature was not tied, but it was placed so that it could be tied in the event of bleeding that could not be controlled otherwise. While an assistant compressed the aorta with a finger a longitudinal incision, extending upwards from the bifurcation for three-fourths of an inch, was made in the anterior wall of the aorta. After removing, in several pieces, a dark friable clot, evidently of recent formation, which lay beneath the incision and protruded into the left common iliac artery, the embolus itself was uncovered, and easily forced through the wound by pressure, from below upward, on the right common iliac artery, into the orifice of which the lower end of the embolus had been driven. There were apparently no firm adhesions between the obstructing mass and the intima, which appeared to be smooth and undamaged. The embolus, or perhaps we should say the embolus with the old thrombi which had gathered about it, measured 3.1 cm. by 1 cm., weighed .75 gramme, and was bullet-shaped, the distal end being bluntly rounded, the proximal end irregular, as though a portion had been broken off. The ends were dark red in color, and separated by a white band, .7 cm. in width, which sent a narrow prolongation toward the proximal end. After milking several more small fragments of clot from the left common iliac, pressure on the aorta was relaxed for an instant, in order to wash any remaining coagula through the wound, and the aorta closed with a continuous through-and-through silk suture, over which a second continuous suture, including the outer coats only, was inserted. The posterior parietal peritoneum was drawn together with a continuous suture of catgut, the abdominal wall with interrupted stitches of silkworm-gut.

The operation, which lasted about one hour, had little immediate effect on the patient's general condition. The temperature remained normal, the respirations continued at the rate of 40 to the minute, and the pulse, which could be felt in both femoral arteries, was slightly accelerated, varying, as nearly as could be estimated, between 75 and 130. On the following day the pulse failed in the right femoral artery, the temperature rose to 101°, a small quantity of bright red blood was coughed up, and numerous moist râles could be heard over the chest. On the second day dulness appeared over the lower lobes of both lungs, the heart

became more feeble, and pulsation could not be felt in the left femoral artery. On the third day death occurred from cardiac weakness and pulmonary œdema. An autopsy could not be obtained.

On first viewing the patient whose history has just been related we discarded operation, because of the long time the embolus had lain in the aorta. Later, however, we realized the significance of the striking difference in the appearance of the right and the left legs and considered operation mandatory. In addition to this narrow escape from making an inaccurate "snap" diagnosis, several other features in this case stand out as highly instructive for the future building of the living pathology of embolic obstruction of the arteries, viz., the absence of occlusive thrombi in the femoral arteries, permitting them to resume their function after a number of days of inactivity; and, despite the long duration of the arterial obstruction, the absence of perceptible adhesions between the embolus and the intima, and the macroscopic smoothness of the intima, findings that allow us to entertain the possibility of restoring the circulation in the large vessels even after it has been interrupted for a long period. It may be that if our patient had survived, and the heart had contracted with a vigor approaching normal, thrombosis at the site of operation would not have occurred; it may be that cessation of femoral pulsation shortly before death was not due wholly or even principally to the alterations in the intima and the changes brought about by the arterial wound.

Notwithstanding the possibility just mentioned it cannot be emphasized too strongly that, in order to preserve a part from impending embolic gangrene, the embolus must be removed as soon after its impaction as possible, not only because of the increasing injury suffered by that portion of the intima which lies in contact with an unremoved embolus, which injury predisposes to thrombosis after arteriotomy, but also because impending quickly becomes actual gangrene, and dead tissues cannot be resuscitated. Further, in embolism of a large artery the early relief of the strain put upon the heart should be kept in mind.

The prompt diagnosis of embolism of the extremities generally presents no great difficulties, but even careful observers have, at times, been unable definitely to locate the exact site of the arterial obstruction. In four of the cases mentioned above (Sabanajew, Murphy, Handley, Key) and in another to be cited later (Stewart) the artery was incised some distance below the point of occlusion. In one of these cases the obstruction was not found, in two it was removed by indirect means

through the original incision, in the other two by a subsequent incision directly over the clot. An accurate diagnosis cannot be made from the symptoms of ischæmia merely. Pain, according to our observations, is acute in the region deprived of blood, and, despite the usual teaching, absent or trivial over the site of the obstruction in the artery. Pallor, fall of temperature, hypæsthesia, and paresis followed, in the event of local death, by the discoloration of gangrene, anæsthesia, and paralysis likewise are limited to that portion of the limb in which the circulation is arrested. All of these symptoms are indicative of ischæmia solely, and the area of ischæmia never reaches the level of the arterial obstruction. The reasons for this, although obvious, are often overlooked, and the site of obstruction is thought to be much lower than it really is. If the affected artery can be palpated there is no excuse for a mistake in the localization of the obstruction. At the site of obstruction the artery may be hard and tender; above this point it pulsates, below it does not pulsate. If the site of obstruction cannot be palpated one may find pulsation in the vessel or its superficial branches at a higher level and fail to find pulsation in the vessel or its branches at a lower level. These observations, with the knowledge of the usual site of embolic impaction, *i.e.*, where the vessel suddenly diminishes in size as the result of giving off a large branch or bifurcating, will generally suffice to determine with fair accuracy the point of occlusion. If the artery is exposed by incision at the suspected point and found to be pulseless throughout the length of the incision the artery should not be opened in this situation to determine whether it is empty or not (palpation suffices for that) or to permit the passage of probes or catheters, both of which are dangerous in that they injure the delicate lining membrane of the artery; but the vessel should be followed by lengthening the incision in the overlying tissues, or by making another incision, until a point is found above which there is active pulsation. The artery may then be incised, evacuated, and, with due regard to the rules laid down for angeiorrhaphy, sutured.

Arteriotomy for embolism, despite its rational and seductive character, must, of necessity, be followed by many disappointing results. All of the patients thus far operated upon were suffering from cardiac disease, most had atheromatous arteries, and in at least five cases there were evidences of previous embolism of arteries other than the one operated upon. Because of this tendency to embolic showers one can never be sure that the embolus that he is extracting is the last one to be thrown into the circulation. Notwithstanding these gloomy reflections we believe that, in view of the five cases in which undoubted

benefit has followed evacuatory arteriotomy, the procedure has attained a permanent place in operative surgery, and should be resorted to more frequently in the future with increasingly beneficent results. Aside from the technic necessary for successful angeiorrhaphy, and in addition to an early accurate diagnosis followed by immediate operation, the best results after embolectomy are likely to be obtained in a young patient with young arteries and a strong heart. Further, since obstruction is, generally speaking, more dangerous in a large than in a small artery, and since operation is easier upon a large than upon a small one, the greater the size of the affected vessel the more gratifying the results.

Arteriotomy for thrombosis was performed first by Lejars in 1902. His patient, a man aged twenty-six years, developed thrombosis of the femoral artery and gangrene of the foot following a severe contusion of the left inguinal region. Six days after the accident the artery was opened, a thrombus removed, and the artery sutured. Thrombosis recurred, and the leg was amputated below the knee. In 1905 we attempted a similar operation on the femoral artery with a similar result, as will be related in the next section of this article. In 1908 Lecène, and in 1909 Ranzi, each opened the brachial artery, the former for so-called spontaneous thrombosis in a tuberculous subject, the latter for traumatic thrombosis; in each instance the thrombosis recurred.

The results in these cases, with the knowledge of the lesions occurring in traumatic and " spontaneous " thrombosis, force us to the conclusion that simple removal of the thrombus is useless, or worse than useless. The cause of the thrombosis, *i.e.*, multiple fissures in or curling up of the intima (following a contusion) or endarteritis, is not suppressed; indeed, in view of the additional injury perpetrated by arteriotomy, the conditions are rendered more favorable for coagulation in the vessel.

4. *Resection* of a contused and thrombosed segment of an artery, followed by end-to-end union, would, if the vessel were healthy, offer as fair a chance for re-establishment of the circulation as circular arteriorrhaphy for accidental wounds, which operation we have on several occasions performed with success. Unfortunately, in many of the cases designated traumatic thrombosis injury is only one, and not always the chief, contributing factor; in these cases the artery is already diseased, and suffers obliteration from a contusion that might have failed to rupture the intima of a normal artery. Our only experience with resection for traumatic thrombosis was obtained in June, 1905, and related in this Academy in May, 1907.

The patient was a man, aged sixty years, with mitral regurgitation and advanced atheroma. Twelve hours after a contusion of the left inguinal region he complained of severe pain, first in the popliteal space and later radiating down the leg to the foot and toes, which pain was followed by the prodromal symptoms of gangrene. The femoral artery could not be palpated because of the swelling consequent upon the contusion. Owing to this fact, to the absence of ischæmia in the thigh, and to the seat of the initial pain, we made the mistake to which we called attention in an earlier paragraph, and concluded that a large clot embolus had been swept from the point of injury and lodged at the bifurcation of the popliteal artery; consequently about 24 hours after the injury we opened the popliteal artery and, finding no clot, passed a probe gently up into the vessel for about six inches, without encountering any obstruction, thus committing, according to our present ideas, two more mistakes, *i.e.*, opening an empty artery to see if it were empty, and extending the injury to the intima by probing the superjacent segment. After suturing the popliteal artery, the femoral artery was opened and the thrombus removed. It was then found that, like a valve, a calcified portion of the intima had been turned into the lumen of the vessel, probably occluding it one-half. The atheromatous plate was removed and the artery sutured. As pulsation below the injured point ceased almost immediately the arterial sutures were removed, the new thrombus extracted, and the artery resutured. After a brief period the thrombosis recurred. The injured portion of the artery was therefore excised and an end-to-end anastomosis performed. This likewise failed to reëstablish the circulation and the gangrene progressed rapidly, finally necessitating amputaion through the thigh. The patient recovered.

The only hope of success in arterial resection for "spontaneous" thrombosis would be in a case in which the causative lesion is a narrowly limited band of endarteritis; in all other instances of "spontaneous" thrombosis the tendency to coagulation would only be accentuated by contact of the blood with an arterial wound.

The amount of artery that may be excised, without rendering circular arteriorrhaphy impossible of execution, varies somewhat with the situation; in the neighborhood of joints, flexion of the limb can be utilized to diminish tension on the anastomotic suture; in regions in which the artery is bound to the surrounding tissues by branches anastomosis, after the removal of a large extent of artery, would be impracticable without severing these branches, an expedient that would generally be contra-indicated. Enderlen was able to approximate the ends of the popliteal artery after resecting 4 cm. for aneurism; Kümmel, the ends of the femoral artery after resecting 5 cm. during the excision of a carcinoma of the inguinal region.

The length of the resected segment could be greatly extended if, instead of directly uniting the ends of the artery, a section of another vessel were interposed between these ends. Since to repair a large artery by sacrificing another artery of equal size would, even if success-

ful, simply transfer the danger of ischæmia from one part of the patient to another, or, if an obliging friend or relative would surrender the needed bit of vessel, from one individual to another, an arterial graft would necessarily have to be taken from a fresh cadaver or from one of the lower animals. So far as we are aware only one attempt, which failed, has been made to transplant a segment of artery from a fresh cadaver to a living individual, and that by Delbet, who thus filled a gap between the ends of the femoral artery, after the excision of an aneurism. Owing to the cytolytic effect of the blood and the body juices on alien tissue, homoplastic transplantation, particularly from a cadaver, and heteroplastic transplantation would seem to be of little promise in vascular surgery, in which even slight degenerative changes in the vessel wall are sufficient to induce thrombosis.

Whether autoplastic venous transplantation, which at once suggests itself as a simple method for overcoming the difficulties mentioned above, will prove reliable or not can be determined only by the results which future trials may bring to light. At the present time, however, the remarkable and stimulating experiments of Carrell, and the favorable clinical reports of venous grafting for conditions other than vascular obstruction, encourage the hope that a portion of a vein might be induced to functionate permanently for a thrombosed segment of an artery. In 8 of the 13 cases thus far published (Goyanes, Omi 2, Tuffier, Pringle 2, Mantelli, Lexer 2, Goecke, Krause, Enderlen, Pirovano), in which a venous graft was employed to replace a corresponding extent of artery (popliteal, femoral, brachial, axillary) that had been excised for aneurism or malignant disease, the immediate results were satisfactory (Moure).

Which vein should be chosen for transplantation depends upon the artery involved. If the artery has two venæ comites one of these could be selected. If there is only one venous satellite it should, as a rule, be spared, because in the event of failure both artery and vein would be obstructed. If the companion vein must be preserved the surgeon might employ a vein which does not accompany an artery, *e.g.*, the saphenous or the external jugular, or one of the venæ comites of an artery other than that affected.

It should not be forgotten that a venous transplant containing valves must be placed in such a way that the valves will not interfere with the passage of blood through the transplant. Another matter, to which attention should perhaps be directed, is the support of the walls of the transplant. Under the impact of the arterial stream the grafted vein dilates to twice the size of the artery, thus causing the blood to

swirl in eddies and, as in aneurism, predisposing to thrombosis. Efforts have been made to prevent this dilatation by turning the vein back on itself, like a cuff, and by suturing the surrounding tissues over it. We suggest a third method, which might be employed in suitable cases of thrombosis. Since in many instances of intravascular coagulation the intima alone is at fault, it has occurred to us that, instead of resecting the artery, its internal coat might be peeled out, and replaced by a piece of vein. This would leave the outer coats of the artery as a firm support for the vein, and the vein would form a new lining membrane for the artery. In some cases of traumatic thrombosis it would probably not be necessary to remove even the tunica intima before placing the vein in position.

5. *Catheterization* of the arteries of a stump left after amputation for arteriosclerotic gangrene, in order to remove clots and thus minimize the risk of necrosis of the flaps, was suggested by Severeanu in 1894. As the passage of catheters and probes into an artery can serve only to injure its delicate endothelial lining and encourage thrombosis, we believe the procedure to be harmful rather than beneficial.

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GALL-STONES

A STATISTICAL STUDY OF CASES OCCURRING AT THE BOSTON CITY HOSPITAL

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THE material for this paper is culled from 400 cases of gall-stones entering the surgical wards of the Boston City Hospital in the years 1907 to 1913, 6 years. The diagnoses of gall-stones, cholecystitis, empyema of the gall-bladder, etc., were made. Only such cases have been used in this study in which stones were found at operation, 226 cases. The remainder were either sent home unoperated or were operated upon, and no stones found.

There were 220 cases operated upon, of whom 55 were males and 182 females, the proportion being one male to 3.3 females. This preponderance of women is real, for to the surgical wards as a whole two men are admitted to every woman. In the forty-ninth report of the hospital the admissions for surgical diseases were 3772 men and 1718 women. The ages of the men fall into decades as follows:

20–30	5
30–40	8
40–50	20
50–60	7
60–70	6

The youngest was 20, and the oldest 66.

The ages of the women were:

10–20	3
20–30	17
30–40	55
40–50	38
50–60	30
60–70	12
70–80	2

The youngest was a girl of fifteen and the oldest seventy-eight. Because of the youth of the girl I append her history:

547–208. Three days before entrance an attack of pain in the upper abdomen accompanied by vomiting. Jaundice for three days. Several similar attacks during past year. Tenderness and spasm in right upper quadrant. At operation about fifty stones were found in a distended gall-bladder. Cystic duct also contained stones.

From a comparison of these tables of ages it is readily seen that a majority of the male cases occur in the fourth decade, and that 60 per cent. of the cases come between 30 and 50 years. A majority of the female cases came, however, one decade earlier, between 30 and 40 years. Nevertheless, 60 per cent. of them also fall between the years 30 and 50.

Considering both males and females together out of 220 cases, but 3 came before 20 years of age and but 25 before 30 years, and only 20 after 60 years. It is, therefore, evident that gall-stones are most common at the period of adult age, 30–60 years.

Etiology.—In this series 137 out of 182 women were married, 75 per cent. The surgical records of the hospital have been examined to determine the normal, as it were, proportion of married to single women who enter the hospital, 62 per cent. were found to be married. Hence, married women seem slightly more liable to gall-stones than unmarried. Not quite half of these women are credited in the hospital records with having had children. Judging from the size of the ordinary family of the hospital patient class this proportion is too small, and I feel sure that this detail in the histories was overlooked.

Typhoid is mentioned as having been present in the past history of 25 cases—12 males, 13 females. The percentage, however, of men who previously have had typhoid is much greater than that of women, 21 per cent. for the men and but 7 per cent. for women.

Indigestion for some time previous to the operation had been sufficiently bothersome to the patient to cause mention by him in 30 of the cases. Attacks, which in view of the present more definite attack might be called previous attacks, though perhaps unrecognized at the time, occurred in 127. Hence digestive upsets varing in severity from chronic to acute, severe enough, however, to have been noted by the patient, may be found in the histories of 157, more than two-thirds of the cases.

Pain.—Right hypochondrium 88; epigastrium 70; right side 10; general abdominal 12; right iliac 9; back 6; right shoulder 3; left lower quadrant 3; left upper quadrant 2; umbilical 1; left side 1; right hip 1; between shoulders 1.

Pain of severe type was practically always a prominent, one might say the prominent, symptom, occurring in 212 cases. Its situation varied considerably. By referring above one will see that the right hypochondrium, 88 cases, and the epigastrium, 70 cases, are the two most common sites. It is of interest, however, to note that it may occur on the left side. Obviously a sufficiently enlarged gall-bladder may give rise to symptoms in the right iliac fossa.

Pain radiated to back 46; right shoulder 24; epigastrium 5; right hypochondrium 2; both shoulders 1; between shoulders 4; right side 1; chest 2; general abdominal 6; lumbar region 4; sternum 2; axilla 1; pelvis 2; left side 1.

In 101 or 46 per cent. of the cases having pain as a symptom, the pain is described as radiating to other parts of the body after having become intense at its starting point. The regions most referred to are, first, the back, 46 cases or 45 per cent., and, second, the right shoulder, 24 cases, 23 per cent. By referring above it is seen that occasionally the pain radiates to any portion of the thorax or abdomen.

The second prominent symptom is vomiting, present in 137 cases or 62 per cent., varying from mild to severe, persistent and most distressing. Rarely the vomiting contains some blood. The vomiting is often said by the patients to bring temporary relief.

The third symptom in order of frequency is jaundice. Jaundice varying from a yellow discoloration in the eyes to a definite yellow tinge to the whole body is mentioned in the history or physical examination in 107 cases or 48 per cent. The site of the stones is of special interest in these cases of jaundice. Of the 107 jaundiced persons 70 had stones in the gall-bladder only; 25 had stones in the common duct only or in addition to stones in other portions of the biliary tract; 9 in the cystic duct alone, or in conjunction with stones elsewhere, and in 3 the stones are described as being in the "ducts." These figures impress the fact that the presence or absence of jaundice gives no real aid in determining the situation of the stone. The presence of jaundice in a case should impress on one, however, the importance of a careful examination of the common duct, for but 3 out of 25 cases where a stone was present in the common duct were free from jaundice.

Chills occur very infrequently, 9 times in the whole series of 226. When present, however, they are of considerable importance. In every one the gall-bladder was acutely inflamed, the description being "inflamed," "gangrenous," "perforated."

The character of the stools was mentioned in but a few of the cases, 14 clay or white, 2 light colored. A slight detailed study is of interest.

In the 14 where the stools were described as clay-colored or white, stones were found at operation in the common duct in 5 cases, and no stones were found in the common duct in 8 cases. In 5 of these 8 the subsequent history is known: One well for 22 months. One well for 14 months, but has had one attack of indigestion. One well for 2⅔ years. Previously to that, however, the sinus kept breaking open. One passed a stone from the sinus while convalescent. Well now almost 4 years. One still having attacks. In the two cases where the stools were light colored, one had a stone in the cystic duct, and in the second no stones were found in the ducts. The presence, therefore, of clay-colored stools furnishes suggestive, though not positive, evidence that a stone is in the common duct.

In the presence of gall-stones the most commonly noticed signs on physical examination are tenderness and spasm, frequently associated, over the gall-bladder region, rarely occurring separately, one without the other.

Tenderness and Spasm Together.—Right upper quadrant 107 cases; right side 3 cases; epigastrium 3 cases; right lower quadrant 4 cases; general 1 case; left upper quadrant 1 case.

Tenderness Alone.—Right upper quadrant 56 cases; right side 3 cases; epigastrium 1 case; right lower quadrant 2 cases.

Spasm alone without tenderness in 6 cases.

A mass in the abdomen was present in 49 cases with a questionable mass in six additional. The mass was situated anywhere on the right side.

The liver was palpable in 23 cases.

At operation adhesions were noticed in 54 cases, 28 per cent.

This is of interest in its relation to the diagnosis of gall-stones by X-ray (*Surg., Gyn. and Obstetrics,* February, 1914, Cole).

Gall-Bladder.—Pus 28; contracted 23; distended 54; inflamed 5; gangrenous 4; perforated 5.

At operation pus was present in the gall-bladder in 28 cases. It was found in both contracted and distended bladders. A contracted bladder occurred in connection with a stone in the common duct more frequently than does a distended bladder. Of the 23 cases of contracted bladders, 9 or 38 per cent. had stones in the common duct, while in the 54 cases of distended gall-bladders but 4 or 7 per cent. had stones in the common duct.

While the number of cases of jaundice with stone in the common duct where the condition of the gall-bladder is mentioned is small, in general, it is in accord with Courvoisier's law as given in *Keen's Surgery,* vol. iii, p. 1063. "In cases of chronic jaundice due to obstruction

of the common duct, a contraction of the gall-bladder signifies that the obstruction is due to stone; a dilatation of the gall-bladder, that the obstruction is due to causes other than the stone."

In this series of cases of jaundice where a stone was found in the common duct, the bladder was contracted 9 times and distended but 3 times.

Cholecystostomy was performed in 177 and cholecystectomy, complete or partial, in 24 cases. The records are incomplete in the remainder. In this place I have no comment to make on the comparison between two procedures.

The convalescence in the vast majority was quite uneventful. The two complications which appeared were sepsis and pulmonary troubles. When it is remembered how frequently the gall-bladder was inflamed or contained pus, it is surprising to learn that but 12 cases had a convalescence complicated by sepsis. The sepsis usually came in the abdominal wall, rarely as a collection of pus about the gall-bladder.

Pulmonary complications developed in 14 cases, and in a majority of these caused death. A more detailed review of this will follow.

The immediate subject matter of this portion of this review is collected from 31 cases who died after operation in the hospital.

When one comes to an analysis of the cases of this series dying in the hospital, the mortality is excessive. A further study of them, however, shows that some belong to the class of surgical emergencies. Although it is scarcely fair to the statistics of gall-stone operation to add them, we have done so, inasmuch as in the hospital records they were classed as deaths following gall-stone operation. One word before considering the cases more in detail. The Boston City Hospital draws its patients from a large city which has its proportion of ignorant, worn-out, underfed individuals, who are poor surgical risks. The death of a few such patients will always keep the mortality rate of such a hospital high.

Thirty-one cases died in the hospital as a result, or in spite of, operation; 9 were men, 22 women; of these 18 had been married. The ages of the women varied from 30 to 78, of the men from 28 to 72. They fell into decades as follows:

Age	Women	Men
20–30	0	1
30–40	7	1
40–50	5	0
50–60	6	1
60–70	1	5
70 plus	2	0

The presence or absence of former attacks of gall-stones, of typhoid fever, the character or situation of the pain, its reference to other parts of the body when seen in tabular view show no reason why these cases should have died while others recovered.

The patients in this series, however, were more severely diseased than those who recovered, as evidenced by the frequency of chills, jaundice, enlargement of the liver and presence of a palpable mass in the region of the gall-bladder. Among the 31, 5 had chills, 18 were jaundiced, 5 had enlarged liver, one having in addition an enlarged spleen, and in 5 a palpable mass in the gall-bladder region was present, while in an additional one there was a questionable mass. The condition of the gall-bladder was found at operation and the situation of the stones also showed the greater severity of the process in these than in those who recovered. The gall-bladder was inflamed, neurotic, perforated, or contained pus in 8 cases, and stones were found in the ducts in 16 out of 31, in conjunction with stones in the gall-bladder in 9, and in the ducts alone in 7.

The perforated cases were as follows:

178–32. Male, aged sixty-two. Previous attacks four and six years ago. One week ago attack of severe pain in back. Improved until yesterday when seized with sudden sharp griping abdominal pain, not well localized; vomiting, chills, fever; abdomen distended, tender in lower right side, general spasm; dulness (both flanks). As soon as peritoneal cavity opened large amount of bile and a few small stones escaped. One large stone free in the abdominal cavity. Drained. Did not react to stimulation and died.

500–158. Woman, aged thirty-nine, married; always well until two days before entrance when doubled up by severe pain in right lower quadrant. Pain recurred; at intervals less severe. Temperature 101°, pulse 100, white cells 18,000. Pain and tenderness over entire right side of abdomen. At first refused operation. When abdomen opened, pus, bile and two small stones escaped. Gall-bladder was found perforated and contained more stones. Steadily failed and died next day.

During convalescence three cases developed sepsis in the wound, one dying as a result nine days after operation.

500–258. Woman, aged forty-two, married. Had had previous attacks; jaundiced; tenderness over the gall-bladder and epigastrium, with a questionable mass in the epigastrium, was present. On day of operation temperature was 101°, pulse 95. The gall-bladder was found distended and its lining necrotic. The bladder, ducts and liver were full of gravel. The duodenum was necrotic

and the common duct plugged. Tube was fastened into the bladder and another into the duct. During convalescence enough gravel was discharged to plug the drain tube. The sinus sloughed, a fecal fistula developed and the patient died on the ninth day.

Another case developed erysipelas 13 days after operation and died six days later.

In two cases (150–140 and 524–182) a malignant mass was found at autopsy or operation. In one, a married woman of forty-eight years, with left-sided pain, clay-colored stools and jaundice, a stone was found in the common duct with a malignant mass in the duodenum. A cholecystenterostomy was done and the patient died in three days. No definite cause given. The second case was that of a man fifty-four years, with jaundice and enlarged liver and spleen, with stones in the gall-bladder, cystic and common ducts. He developed acetonuria and died on the thirteenth day. At autopsy a cancerous gall-bladder and stones in the hepatic duct were found.

Cerebral thrombosis, acute dilatation of the heart and dilatation of the stomach account for four deaths.

The two most common causes were pulmonary complications and a gradual progressive weakness, finally ending in death.

Among the 31 cases the convalescence was complicated by pulmonary troubles in 8 cases, ending in death in all.

In the following four cases such a fatal complication might be, perhaps, excusable because of the condition of the patient.

Case 550–74.—A man of sixty-two entered the hospital in a very shaky condition, having been drinking. The operation was postponed for five days, when it was thought best to do it. There was pus in the gall-bladder. He was a poor risk but the risk had to be taken. He developed pneumonia and died in three days.

Another case (530–50), of a fat woman aged sixty-seven, who had a cardiac murmur and a fibroid of the uterus with a history of various troubles reaching back a number of years, died two days after operation with evidences of a pneumonia.

Another case (560–226) was that of an eighty-seven-year-old woman with an inflamed gall-bladder.

A fourth (515–86) had pus in the abdomen at operation—woman of fifty-one years. Had had typhoid and previous attacks of colic. Seven days before entrance had an attack of epigastrium pain which was referred to right hip and shoulder; vomited; became jaundiced. Entered hospital with temperature of 103°, pulse of 100, with a spastic abdomen. Rigidity was marked in right upper quadrant. As soon as the abdominal cavity was opened pus was found. Liver had fibrin on it. Bladder contained pus and stones. She died in 20 days from pneumonia.

Even after deducting these four cases the percentage of 4 out of 31 post-operative fatal pulmonary lesions seems far too large. One would suspect that the more extensive operations would be followed more frequently by pulmonary complications through interference with free diaphragmatic action. If it is granted that removal of stone from a duct requires a more severe operation than from the gall-bladder, the series of cases appears to verify the above statement, for the percentage of those with stones in the ducts dying from pulmonary complications is greater than that of those with stones only in the bladder, although the actual number is smaller.

To attempt to determine why certain cases after operation progressively failed and died is even more difficult. Of these there were nine cases, omitting the two cases of perforated gall-bladder already mentioned, death coming in from one to fourteen days after operation.

> One (156–96) was in a man sixty-nine years old, with pus in the gall-bladder.
>
> Shock would account for one at least and perhaps more. 505–106, male fifty-seven years. Stone in cystic duct, drained. Eleven days after discharge readmitted, weak, jaundiced. At the second operation stone found in the duodenal wall. Never rallied from operation.

Even after deducting these cases a number are left where the cause of death as recorded in the hospital records appeared to be simply a progressively increasing weakness without any definite pathological condition which was made out clinically. This may be the condition described by Crile, in *Surgery, Gynecology and Obstetrics* for April, 1914, from which article I quote: "In the common duct operation, death can rarely be attributed to the loss of bile, but is due to the gradual development of an asthenic state characterized by dulness of the mental and motor reactions, a dry tongue, partial suppression of bile, anorexia, and scanty urine, together with the impairment of the entire digestive system,—a progressive adynamic state which is extremely resistive to any known treatment." He considers this due to impairment of the nerve supply of the liver which follows the course of the vessels and common duct.

The mortality of this series as a whole is large, 31 out of 226, 13 per cent. As I said, however, earlier in this paper, certain cases are included which perhaps do not really belong here as far as the cause of death is concerned. Let us compare these figures with the mortality percentage as determined by Dr. Codman after combining the figures furnished from various hospitals.

He considers the mortality of cholecystostomy as 3 per cent. and cholecystectomy as 4½ per cent. Those figures I understand are in uncomplicated cases. If from the series in this paper the complicated cases with stones in the common ducts, cases of peritonitis and perforated gall-bladder, and cases with heart disease (18 cases among the 31), are removed, the combined mortality of cholecystectomy and cholecystostomy at the City Hospital is 5 per cent. plus.

End Results.—Of these operations the end results, not including those cases who died in the hospital, have been learned in 91 cases, either by letter or from personal interview. The actual number of patients operated on is at least four less, as four were operated on twice.

The length of time since operation varies according to the following table:

	Cases		Cases
1–12 months	1	5–6 years	11
1–2 years	17	6–7 years	6
2–3 years	20	7 plus	3
3–4 years	19	Number of years doubtful	1
4–5 years	13		

Of the 91 cases, 74 or 81 per cent. consider themselves well, cured by the original operation. Of this number 5 qualify this statement by saying that they still have some indigestion. Four cases are having trouble, not apparently due to gall-bladder disease. Three still having attacks of pain, etc., suggestive of gall-stones and one is "not well."

In the series are a few with post-operative herniæ, very few considering that the wounds have been drained. There is, however, a number who say that they have never really been well since the operation. There is nothing suggestive of gall-stones and nothing definite in history or examination is found aside from the fact that something in general physical well-being was lost and has not been regained. One died 8 months after the operation from pneumonia.

The failure to obtain a permanent primary cure is due, in the majority of cases, to stones which have been overlooked and left behind. The difficulties began at once during convalescence in 2 cases who, while still in the hospital, passed stones not removed at the operation from the drainage tube. One has been well since then, now for 3 years, 3 months. The end result of the second case was not learned. Some cases returned after discharge with symptoms warranting a second operation, by which stones were found which had been missed.

One case returned in a few days and stones were found in the sinus. The patient has been well since, five years.

Stones have been found in these secondary operations in this series in the gall-bladder and the cystic and common ducts.

One case, 1 year 10 months convalescent, developed jaundice and diabetes. Stones were found in the gall-bladder; well now for 3 years 5 months.

One patient where the stone was found in the cystic duct has been well for six years. Two cases have been well respectively 4 years 8 months and 8 years following secondary common duct operations.

That complications subsequent to discharge from the hospital may arise not due to stones is shown by the following cases:

One case returned in five months with symptoms suggestive of stone. Two years ago a secondary cholecystectomy was done. No stones were found. The patient has been well since. Two cases had the sinus open spontaneously. No more stones were found and both have been well 2¾ years. One case nine months convalescent developed an abscess below the liver.

The difficulties appear to have been caused by either too short drainage of the gall-bladder or by failure to remove at the first operation all the stones.

The conclusions which may be drawn from this review of cases are:

That gall-stones occur most commonly in women of adult age; that the history and physical examination usually are suggestive of gall-stones; that the presence of jaundice and clay-colored stools is suggestive, but not indicative, of stone in the common duct; that a permanent cure in the vast majority of cases is brought about by primary operation; that the complications to be most feared are pulmonary, and that the mortality is slight.

THE SURGICAL TREATMENT OF GASTROCOLOPTOSIS*

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The surgical treatment of gastroptosis is not viewed with any degree of enthusiasm by the medical profession in general. It is commonly assumed that the end results attained by operation do not justify the means employed, and that, while an immediate temporary benefit may be accomplished, the condition of the patient after one or more years is not greatly improved, or may even be worse. The favorable reports of Rovsing,[1] Beyea,[2] and of Coffey,[3] resulting from their method of gastropexy, are opposed by such statements as those of Binnie,[4] "the condition present is one of general visceral ptosis, hence the operation is commonly futile," or of Moynihan,[5] who writes of gastroptosis, "it is not the most important part of a more widespread disorder." It is also the contention of the majority of internists and gastro-enterologists that the condition can be cured in all cases by non-surgical methods.

In the majority of cases non-surgical treatment will effect a cure. Rest in bed, with elevation of the foot of the bed, gastric lavage (although this is said to be absolutely contra-indicated by some), forced feeding with easily digested food of high nutritive value, in small quantities at a time but frequently repeated, together with general tonic treatment, to be followed after the stomach has regained some of its lost tone by regulated abdominal exercises and the wearing of a properly fitted abdominal belt, or pad, such as that recommended by Lane and by Rovsing, or a surgical corset, frequently will greatly relieve or cure the symptoms, and a radiograph after such treatment often shows the stomach elevated to approximately a normal position.

There will be, however, a number of patients who will not or cannot carry out the long course of treatment of six or eight weeks in bed, or who are not cured by non-operative means, and corsets or belts are not of much use in the type of virginal splanchnoptosis. They are frequently patients of what are commonly called the neurasthenic type, are generally miserable, complain of vague gastric and abdominal pains and digestive ailments, and are not looked upon as favorable subjects for any operation; but if operation is performed in properly selected cases and, what is equally important, the proper after-treatment is carried out, a large number may be relieved or cured.

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There are various theories as to the cause of gastrocoloptosis. Glenard's theory of a nutritional disease due to some vague sort of hepatic diathesis, resulting in atrophy and prolapse of the small intestine, thus depriving the stomach of its support, if accepted would hardly be a favorable basis on which to establish a cure by surgical procedure. The same may be said if we accept Stiller's theory, that the condition is due to a congenital laxity and asthenia and degeneration of all the tissues of the body. But is it necessary to accept these theories?

Rovsing divides gastrocoloptosis into two types, the virginal and maternal, the former being due to tight lacing of corsets, the latter to changes resulting from pregnancy. While both these elements may enter into the etiology in some cases, a far more tenable theory, in view of the facts that fully half the cases observed occur in nulliparous women, that narrow waists obtained by tight lacing have not been fashionable for a number of years, and that these patients rarely give any history of tight lacing, is that of Satterlee and LeWald in their articles on "Water-trap Stomach." Their theory embraces first, a congenital faulty development of the gastro-intestinal tract, with abnormally long mesenteries of the stomach and colon and a long pelvic colon, plus bad intestinal hygiene and bad habits. The greater frequency of the condition in women might readily be explained by the narrow costal arch and smaller amount of space in the upper abdomen and the broad roomy pelvis occurring generally in the female sex.

When a general visceroptosis is present, the contributing or causal factors mentioned by Coffey and others must be considered; such as improper prenatal rotation of the colon and fusion of the posterior layers of the parietal peritoneum, thus resulting in nephroptosis and cæcum mobile, the loss of abdominal fat, changes in intra-abdominal pressure and the assumption of a position in standing and walking which lessens the natural support of these organs normally fused to the posterior abdominal wall.

The symptoms complained of are those due directly to the ptosed stomach, that is, pain, usually in the left hypochondrium or epigastric region; a dragging sensation; symptoms of indigestion and frequent eructations of gas. Rovsing calls attention to the fact that the distress caused by the ingestion of food is in proportion to the quantity of the food rather than the nature or the digestibility of the meal taken. These gastric symptoms are frequently relieved by lying down. Vomiting is usually not a marked symptom, but in some cases hæmatemesis occurs, leading to a faulty diagnosis of ulcer. As secondary symptoms, constipation, malnutrition, loss of weight, loss of appetite, headaches, anæmia,

and all the symptoms of gastro-intestinal stasis and intestinal toxæmia may occur. Frequently, the patients have been treated for a prolonged period for indigestion and chronic gastritis, or the appendix removed for chronic appendicitis. Radiographic examination of the stomach will show, in most cases, the type of stomach called by Satterlee and LeWald the "water-trap stomach," in which the vertical diameter of the stomach is abnormally long, the greater curvature being three to six inches below the level of the umbilicus, the lesser curvature even being well below this level, while the second portion of the duodenum, being fixed by the gastrohepatic ligament and its retroperitoneal attachments, holds up the pylorus.

Such a picture readily explains how pain may result from the weight of food pulling on the fixed points at the fundus and the duodenal attachments, and, in the presence of a weakened stomach musculature, the failure of the stomach to lift all of its contents up over the long pyloric arm and empty itself in the normal time, thus accounting for the residue found in the stomach at the end of six hours after the bismuth meal.

In the consideration of the possibility of improving or curing this condition by surgical procedure, it is to be reiterated that operation is not to be resorted to unless medical means fail, or, perhaps, in working women who are unable to give up the long time in bed with careful nursing and feeding necessary to cure the *severe* type of cases. However, the conclusions of Dr. LeWald, director of the Röntgen Department of St. Luke's Hospital, are worthy of most careful consideration in view of Dr. LeWald's neutral position between medicine and surgery, and his experience as a pathologist and röntgenologist. Dr. LeWald [6] states his position as follows, based upon a most careful study and analysis of over two hundred cases:

"The indications for and against operation may be summarized as follows:

"(*a*) Care should be taken not to operate on a simple, ptosed stomach, with or without dilation. This rule is subject to occasional modifications.

"(*b*) The typical water-trap stomach of mild degree which does not yield to medical treatment should be operated on.

"(*c*) The typical water-trap stomach of marked degree which shows a large residue in the stomach after six hours should be operated on as soon as diagnosed."

As previously stated, operative treatment has met with strong opposition. Maclaren and Daugherty,[7] in an article on "Pyloroptosis," reach the following conclusions: "First, position of the stomach is not

important, that the pylorus is practically a pelvic organ; second, the principal function of the stomach is mechanical; third, the beginning or first symptom of the so-called neurasthenia is due to gastric atony; fourth, postural drainage and fat feeding, temporarily at least, cures these patients; fifth, from our present experience, we believe that operations on the atonic stomach to change its position and help its drainage have still to be proven advisable, because no operation will take away the muscular atony but will rather aggravate it." All of these conclusions (and I believe they are those usually accepted) sound eminently logical if the premises are correct, but examination of a large number of röntgenograms shows two points which contradict the more important of these premises in many cases. First, that while frequently the pylorus is low, in the vast majority of the patients complaining of symptoms the pylorus is not low or a "pelvic organ," but is kept up in place by the duodenal attachments, or is only slightly lower than normal, while the greater and even the lesser curvature of the stomach sag down below the level of the crests of the ilium and into the pelvis, and the condition is a gastroptosis, or at least a ptosis of a portion of the stomach, and not a pyloroptosis, as it is called by Maclaren and Daugherty, and also by many others (Fig. 1). It is in this class of cases that radiography shows a gastric residue six hours after the bismuth meal more frequently than in those in which a pyloroptosis allowing of drainage is present.

Second, the assumption that the position of the stomach is not important and that the symptoms are all due to gastric atony. While gastric atony is often an important element in determining the symptoms complained of, it is my belief that it is not the sole element present but bears the same relationship to the predisposing cause, *i.e.*, the gastroptosis, in causing the symptoms, as exists between predisposing and exciting cause in the etiology of many diseases. Radiograph examination of many cases of gastroptosis shows that frequently the stomach is not markedly atonic (Fig. 1), and it would appear to me to be a fair assumption that, while if the stomach were in a normal position the stomach musculature would be sufficient to empty that organ in the normal time, in the presence of a gastroptosis of the water-trap or drain-trap type, a comparatively small amount of loss of muscular tone may render it impossible for the muscular wall of the stomach to lift the stomach contents out of the sagging portion of the stomach up over the long pyloric arm shown by the radiograph in these cases. Radiographic examination frequently, but not always, shows that immediately after the bismuth meal there are good peristaltic waves in

the stomach, which begins to empty normally, but finally appears to relax and a residue remains after the normal emptying time.

I further believe this view of the relationship between these predisposing and exciting causes (position of the stomach and atony of its walls), associated with or causing the symptoms of gastroptosis, aids in the understanding of the relation between the position of the stomach and the symptoms apparently caused thereby. That is, it is frequently stated that gastroptosis exists without symptoms, therefore, it does not cause symptoms, so why interfere with it as it may be a normal position for that individual's stomach. It is granted that gastroptosis may exist without symptoms just as astigmatism, or eye strain, may exist without symptoms until, just as in the eye condition, the patient's general health, or nervous or muscular strength, becomes overtaxed, then the normal functional activity fails and the lesion which had previously been present becomes manifest by the symptom exhibited.

If a hypertonic condition of the stomach wall can be attained by non-surgical treatment, the stomach may pull itself up out of its ptosed position, but this result is often difficult to attain by forced fat feeding, posture, etc., unless the treatment extends over a long period; or in other cases there may be sufficient muscular power to empty the stomach even while it remains low, just as cardiac hypertrophy compensates for a valvular lesion.

If, then, surgical treatment is to be attempted or is justifiable, what is the best means to employ?

The ideal operation would be the one which would hold the stomach in place and interfere least with its physiological functions. This is difficult to accomplish; many believe it impossible, and for that reason have given up attempts at gastropexy, and, if any form of operative treatment is attempted, perform a gastro-enterostomy with or without pyloric occlusion.

The methods of gastropexy employed are either the direct or indirect. In the direct method of Rovsing, the parietal peritoneum of the anterior abdominal wall and the anterior stomach wall are scarified with a fine needle, the latter between three linen sutures passed in and out through the seromuscular coats of the stomach wall, parallel with the lesser curvature and about 2 cm. apart. The threads are then led out through the abdominal wall and tied over a glass plate. The theoretical objections to this operation are twofold. First, that a suture passed through a muscular organ such as the stomach, undergoing continual peristaltic movements, might be expected to cut out within a short time, although the scarification of the two contiguous peritoneal

surfaces should allow the formation of adhesions before this occurred. Second, that if firm adhesions of the stomach wall to the anterior abdominal wall did occur, the physiological functions of the stomach would be sufficiently interfered with to cause symptoms. Rovsing's personal statistics, as a result of operation in 163 cases, showed 50.6 per cent. of cures, 14.7 per cent. of great improvement, 11 per cent. improvement, 12.8 per cent. of slight improvement or none, and a mortality of 4.9 per cent. The results of the same operation in 93 cases by other Scandinavian surgeons showed 75 per cent. cured, 9.6 per cent. improved, 11.8 per cent. slight improvement or none, and a mortality of 3.2 per cent.

The indirect method most employed is the method of Coffey, which combines the Beyea operation, of shortening of the gastrohepatic ligament, with suture of the gastrocolic and great omentum to the anterior abdominal wall for a distance of six or seven inches, two inches above the umbilicus, thus making a "hammock" by which the stomach is suspended. If the gastrohepatic omentum after plication were sufficiently strong to continue to maintain the weight of the stomach, Beyea's operation would be ideal, but it is frequently thin and easily stretches. It was for this reason that the Coffey operation was devised. The objection to the latter operation is that in a number of cases the adhesions stretch and the ptosis recurs, and Rovsing states that the stomach may become ptosed to the left of the area of omentum sutured to the anterior abdominal wall. Reporting on 41 cases of gastropexy according to his method, Coffey states that 26 were symptomatically cured, 9 very much improved, 4 somewhat improved, 1 unimproved (had tuberculous enteritis), and 1 died of pneumonia. Reed [8] reports a number of successful results, with gastropexy, by a method similar to Coffey's. He makes a modified transverse epigastric incision, separates the peritoneum from the fascia along the lower lip of the wound, and, after shortening the gastrocolic omentum, sutures the great omentum to the fascia from which the peritoneum has been separated.

A number of surgeons, who do not approve of the different attempts at gastropexy, particularly those reporting in the German literature, perform gastro-enterostomy with pyloric occlusion for the relief of gastroptosis, frequently with the addition of suspension of the pylorus. For the suspension of the pylorus, the fascial strips used as a means of pyloric occlusion, as in the method of Wilms, are employed with various modifications by Goebell [9] and Hoffmann.[10] Pagenstecher [11] and Herscher [12] use the round ligament of the liver to suspend and occlude the pylorus after gastro-enterostomy, and Mariani [13] has sutured

the pylorus into the upper angle of the abdominal wound. Numerous reports demonstrate the bad results following gastro-enterostomy for gastroptosis unless a pyloric occlusion is also done. Schultze-Berge,[14] in uncomplicated cases of gastroptosis, recommends "high suture" of the stomach, which he has done in about 80 cases with good results. In gastroptosis with gastrectasia, or with scar tissue or adhesions in the pyloric region, he considers gastro-enterostomy with pyloric occlusion advisable.

Wiedhoff,[15] in a study of splanchnoptosis in the Wilms Clinic, concludes that splanchnoptosis is due to diminished volume of the abdominal viscera, so that the abdominal cavity is too large for its contents. He believes the various operations for fixation of the ptosed abdominal organs by means of peritoneal folds unsatisfactory, and suggests, if methods of increasing the fat and muscular tone of the patients fail, the narrowing of the lower part of the abdominal cavity by doubling the posterior rectus sheath and overlapping the recti. This method would hardly appear to recommend itself in cases of virginal splanchnoptosis. Coffey, in addition to his fixation operation, in certain cases widens the upper part of the abdominal cavity and narrows the lower part by operation on the recti.

Schlesinger [16] has employed and recommends resection of the middle third of the stomach for severe cases of gastroptosis.

The multiplicity of operative procedures, nearly all of which are open to some form of criticism, indicates that an ideal or generally accepted operation, if such a thing be possible, does not exist. The reports, however, except from those who have devised some special form of operation, are isolated and of comparatively few cases or too soon after operation to ascertain the final results, and it, therefore, seemed worth while to report on the following 10 cases operated on by what seemed to me the most simple method, after a period of from 10 months to 3½ years after operation. The operation done was shortening of the gastrohepatic omentum, with suture of the gastrocolic omentum, for a distance of 6 to 7 inches, to the parietal peritoneum of the anterior abdominal wall, about 2 inches above the umbilicus, similar to the method of Coffey. All the patients were females.

CASE I.—L. E., aged thirty-one, nullipara. Severe progressive neurasthenia and hysteria for years. Periodical attacks of vomiting, sometimes every two weeks. Has lost 40 pounds. Marked constipation. Medical treatment consisting of sedatives, posture, rest in bed, rectal feedings without avail.

X-ray report showed greater curvature 6 inches below umbilicus.

Operation.—St. Luke's Hospital, August 12, 1911. Suture of stomach to anterior abdominal wall after scarification. Three sutures in gastrocolic omentum.

Three and one-half years after operation patient is free from gastric symptoms and has gained 25 pounds. Is still constipated, and radiograph examination two years and eight months after operation shows partial recurrence of ptosis, but to markedly less degree than before operation.

The fixation operation on this patient was less complete than in the other cases.

CASE II.—Mrs. L. H., aged thirty. Severe attacks of pain for two years, usually after eating. Frequent eructations of gas; palpitation of the heart; marked constipation. Possible attack of appendicitis five months ago.

X-ray report showed greater curvature 3¾ inches below umbilicus (Fig. 3).

Operation.—St. Luke's Hospital, May 29, 1912. Appendectomy. Suture of gastrocolic omentum to parietal peritoneum.

Report, February 14, 1913, 9 months after operation: No stomach symptoms except occasionally raises gas. Constipation improved, but occasionally takes laxative.

No answer to letter recently sent.

CASE III.—Miss M. M., aged thirty-five. Pain in left hypochondrium; eructations of gas; distress after eating. Does not vomit. Lost weight. Symptoms date back five years, after lifting a heavy woman.

X-ray report showed stomach 5¼ inches below umbilicus.

Operation.—St. Luke's Hospital, November, 1912. Plication gastrohepatic omentum. Suture of gastrocolic omentum to anterior abdominal wall. Double nephropexy. Appendectomy.

Report, March 17, 1914, 1 year and 4 months after operation: Feels well, no pain or stomach symptoms. Gained 29 pounds. X-ray shows stomach has again sagged 2½ inches below position, on leaving hospital. This patient, however, returned to heavy work six weeks after her operation without wearing any supporting belt or corset.

CASE IV.—Mrs. F. S., aged twenty-five. For five years distress in stomach and palpitation of the heart half hour after meals, relieved by belching. Sensation of being gripped in upper abdomen by a vice. No nausea or vomiting. Lost 40 pounds. Obstinate constipation.

X-ray report showed greater curvature 4 inches below umbilicus (Figs. 1 and 2).

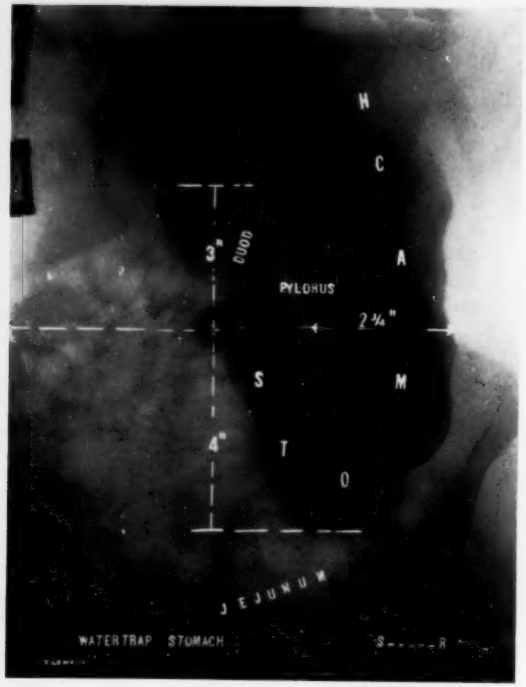

FIG. 1.—Case IV. Before operation. Note ptosis of stomach, high position of pylorus, lack of dilatation or atony of stomach, and pyloric arm seven inches long.

FIG. 2.—Case IV. Two years after suspension operation.

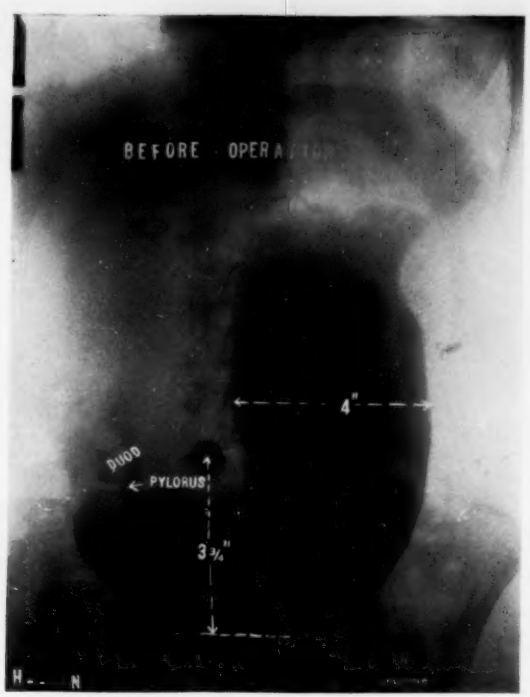

FIG. 3.—Case II. Before operation. Note pyloroptosis and gastric atony and dilatation in contrast to Fig. 1.

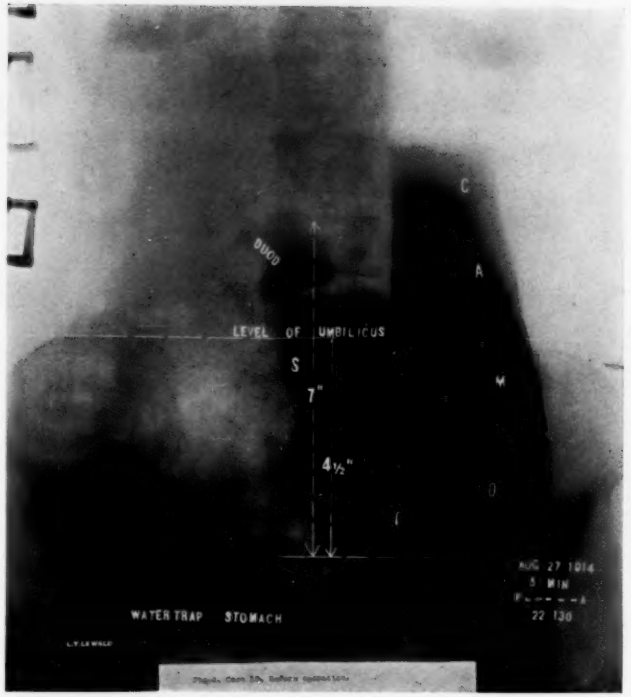

FIG. 4.—Case X. Before operation.

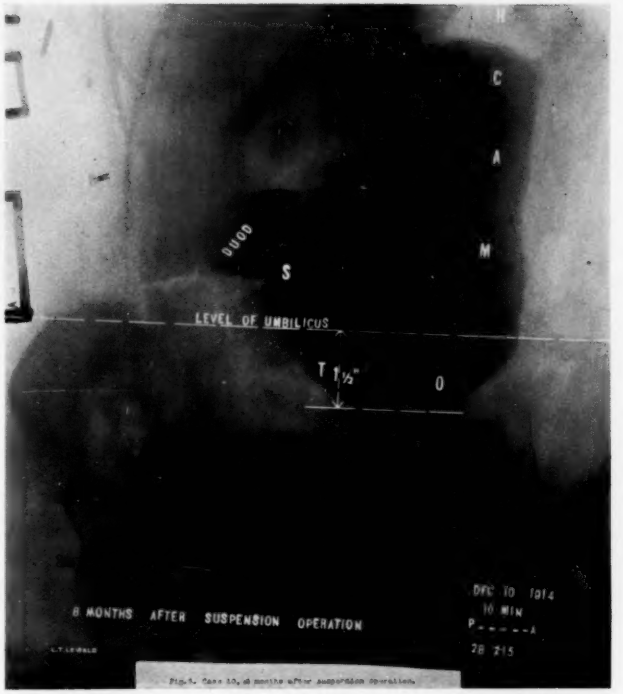

FIG. 5.—Case X. Eight months after suspension operation.

Operation.—St. Luke's Hospital, December 31, 1912. Plication of gastrohepatic omentum. Suture of gastrocolic omentum to anterior abdominal wall. Appendectomy.

Report, December 4, 1914, two years after operation: Feels well. No gastric symptoms. Gained 37 pounds. Has not taken cathartic in 1½ years. X-ray shows greater curvature 1½ inches below umbilicus in normal position.

CASE V.—Miss J. H. In 1909 had constipation and indigestion. In 1910 operated for appendicitis. Symptoms worse after operation. Two subsequent operations for adhesions. Continued to have pain after eating, cramps, frequent vomiting and obstinate constipation. Weighs about 90 pounds.

X-ray report showed greater curvature about 3 inches below umbilicus.

Operation.—Bellevue Hospital, May 29, 1913. Showed band of omentum adherent to cæcal region pulling down stomach and transverse colon. Omentum separated and sutured by row of sutures to anterior abdominal wall two inches above umbilicus.

Report, December 8, 1914, one year and seven months after operation: Feels well. Gained 20 pounds. Bowels move daily. Good appetite. No gastric symptoms.

CASE VI.—Mrs. L. W., aged thirty-nine, multipara. History of gastric disturbance over ten years. Distention of stomach and eructations after eating. Constipation. Operation for fibroids May, 1913. Appendix removed at that time. Gastric symptoms worse since operation for fibroids.

X-ray report showed greater curvature of stomach 4 inches below umbilicus.

Operation.—Bellevue Hospital, August 6, 1913. Plication gastrohepatic omentum. Suture of gastrocolic omentum to anterior abdominal wall. Patient left hospital against advice, and has been lost track of.

CASE VII.—Mrs. J. B., aged thirty-eight, multipara. Dull pain in stomach and epigastric region for seven years. Frequent eructations of gas. Medical treatment on and off with very little relief during that time. Frequent attacks of vomiting. Operation for appendicitis seven years ago. No relief. In bed one month before operation to relieve gastroptosis.

X-ray report, Dr. L. G. Cole, greater curvature prolapsed to within 1 inch of symphysis.

Operation.—General Memorial Hospital, October 2, 1913. Plication gastrohepatic omentum. Suture gastrocolic omentum to anterior abdominal wall. Falciform ligament shortened. Right nephropexy.

Report, December 8, 1914: Appetite good, can eat nearly

everything. Gained 23 pounds. Well except for attacks of what is apparently migraine, every two or three weeks. Considers operation a " great success."

CASE VIII.—Mrs. E. K., aged thirty-six, multipara. For four years has had pain in left arm and side down to foot and up to head. Gets dizzy and face flushes; pain in back, ovarian region and left leg. Attacks of indigestion. Local symptoms due to fibromyoma uteri. Hot flashes.

X-ray report shows gastroptosis. Distance below umbilicus not stated and plates lost.

Operation.—General Memorial Hospital, January 12, 1914. Gastrocolopexy as in previous cases. Supravaginal hysterectomy, leaving right ovary. Appendectomy.

Report, December 7, 1914: Is no better. Still has gastric symptoms, pains and constipation.

This patient had a variety of symptoms, neuralgic pains in the arms and legs, etc., obviously not due to the gastroptosis. A hysterectomy was performed for her fibroid, and gastropexy done at the same time. Is hardly a fair case to judge benefit of fixation operation.

CASE IX.—Miss E. O., aged thirty. Always troubled with stomach, worst past three years. Ten years ago nervous breakdown. Pain and fulness in stomach about one hour after eating. Belching of gas. Vomiting, constipation and headaches. Good appetite, but unable to eat on account of distress. Symptoms relieved by lying down. Treated for gastroptosis for past two years by rest in bed, abdominal binder, etc.

X-ray report showed greater curvature 3 inches below umbilicus.

Operation.—General Memorial Hospital, February 24, 1914. Gastrocolopexy as in previous cases. Appendectomy (appendix apparently not macroscopically diseased).

Report, December 4, 1914, 9 months after operation: States she is greatly improved, has very little indigestion, can eat great variety of food which always upset her before, has gained 18 pounds since operation. Weighs more than she ever did. Still constipated. Has headaches and vomits at menstrual periods, but considers " operation the best thing ever happened to her."

These last three patients live a considerable distance from New York, and it was impossible to get radiographs showing the present position of their stomachs.

CASE X.—Miss A. P., aged thirty-seven. Discomfort in upper abdomen, mostly in right side under costal margin and in epigastrium in daytime when up and at work. Relieved on lying down and at night. Eructations of gas, and constipation. No vomiting.

X-ray report showed greater curvature 4½ inches below umbilicus. Marked residue six hours after bismuth meal (Figs. 4 and 5).

Operation.—St. Luke's Hospital, April 27, 1914. Gastrocolopexy as in previous cases. Appendectomy. Double nephropexy.

Examination, December 15, 1914: Has returned to general housework. Feels well. No gastric symptoms or pain. Gained 10 pounds. X-ray shows greater curvature 1½ inches below umbilicus in normal position.

A summary, then, of the results in 8 cases followed up to the present time, out of 10 operated upon, shows 7 markedly improved or cured. One other patient (Case II), whom I have been unable to reach by letter, was improved when seen nine months after operation, and one patient reports herself to be no better one year after operation. There has been a gain of weight in seven cases of from 10 to 37 pounds, with an average of 23 pounds. Even the patient who reports herself unimproved has gained 3 pounds. Constipation has been improved in 5 of the 8 cases, and in 2 of the most obstinate cases absolutely cured. Two patients had previously been operated on for chronic appendicitis without improvement.

X-ray examination three to four weeks after operation, immediately before or after leaving the hospital, has shown the stomachs at that time in good position. Subsequent examinations eight months to two and one-half years after operation have usually shown the stomach has reached a lower position than when the patient left the hospital, but in no case examined was the stomach as low as previously, or very markedly ptosed, and in those cases in which the stomach remained up the best symptomatic results were apparent. Also, there was only a small or no gastric residue shown by any of the post-operative röntgenograms.

It is my belief that gastropexy alone, after the method employed above, is not sufficient to cure these cases, as it is reasonable to expect stretching of the adhesions or of the shortened gastrohepatic and gastrocolic omentum, unless every effort is made after operation to prevent this occurring. This was shown by Case III. Therefore, after operation the foot of the bed should be elevated for the three weeks that the patient remains in bed. After getting up, the patient should wear a properly fitted abdominal belt or corset, and continue for a time to sleep with the foot of the bed somewhat elevated. Constipation should be prevented by the use of Russian mineral oil and agar-agar, rather than by the use of cathartics, and the diet carefully regulated. If the kidneys are ptosed, they should be anchored at the same time

the gastropexy is performed. Usually the appendix has been removed at the same operation.

It would further seem to me, judging by the results attained in these cases, although only a small number, that in properly selected cases of gastroptosis of the water-trap type, operation is justifiable if non-surgical treatment fails to effect a cure, and that marked improvement may result from a gastropexy and careful after-treatment. It is not to be expected that good results will follow if marked atony and dilatation of the stomach, or pyloroptosis rather than gastroptosis of the type described are present, and cases of this kind should be discriminated against in advising operation. Also, it is obvious, if a pylorospasm, hyperacidity, reflex gastric disturbance from a chronically inflamed appendix or small gastric or duodenal ulcer is the cause of symptoms occurring simultaneously with a moderate degree of gastroptosis, that treatment directed to the relief of the gastroptosis will fail to relieve the symptoms as long as one of the other conditions may be present.

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THE RÔLE OF GASTRO-ENTEROSTOMY IN THE TREATMENT OF ULCERS*

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AND

THE ACTIVITY OF THE PYLORUS FOLLOWING GASTRO-ENTEROSTOMY

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A case of recent date that has been under my care was so overflowing with interesting findings pertaining to the rôle of gastro-enterostomy in the treatment of ulcers of the stomach that I have been stimulated to present a few thoughts on the subject.

The case referred to was one of gastric ulcer, upon which a gastro-enterostomy had been supposedly done in a clinic in another city. The case was referred to me by Dr. Carroll, whose clinical findings are as follows:

> This patient, M. J., is a colored woman, unmarried, aged twenty-six. She has been operated upon three times; first, six months previous to coming to my service at the University Hospital. Upon inquiry it was learned from the former surgeon that he had operated for gastric ulcer. He stated that he had done a gastro-enterostomy. The second operation was exploratory in character. This was performed after she entered the University Hospital, June 20, 1913. The object and aim of this second operation was to find out what the condition was and to correct it if possible. The third and last operation, which was the corrective operation, was done at St. Joseph's Hospital on December 23, 1913.
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> The present trouble began about three years ago, previous to which time she had been an exceptionally well woman. She stated that before the first operation she had much pain in the

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abdomen and in the epigastrium an hour or an hour and a half after eating; that she had vomited blood; that food relieved these pains for a short period, and that she had become constipated also about this time. These acute symptoms had followed a period of a year of what she called "bad indigestion." She states that for a short time after this operation she was relieved of most of these pains, but that later more severe pains, obstinate constipation, vomiting, and a sense of great pressure in the epigastrium became almost constant.

It is of interest to note that she said that, "once the bowels were freely opened, undigested food was passed for a time, within a few hours after its ingestion." This was later found to be true. Because of these increasing troubles, she came for treatment to the University Hospital on June 20, 1913, where I first saw her. The examination by the gastro-enterologist revealed an intense mucous achylia gastrica. There was no blood found in the gastric content, and a specimen of duodenal content, aspirated with the Einhorn tube, contained bile, but no blood. A "fasting stomach test meal" of rice demonstrated a retention of some of the meal for a period of 12 hours. Several stool examinations were negative to blood, but at times practically an entire meal of almost unchanged food residue was found three to five hours after ingestion, following "high enema."

On palpation of the abdomen there was tenderness in the umbilical region, even on slight pressure, and dull pain in the region of the cæcum and ascending colon. There was distention. No tumor mass could be made out. The entire lower abdomen was rather tympanitic and splashing sounds were heard at various times in the ascending colon and in the stomach. Much difficulty was experienced in securing the earlier series of X-ray pictures; first because of the vomiting of the patient; second, because of the thickness of the abdomen, and on account of not having at our disposal a strong enough apparatus to penetrate it. These plates definitely, though faintly, demonstrated that some bismuth was leaving the gastric bag, not only by the stoma, but also by the pylorus. Since this dual exit was known, and also because of the persistent vomiting and pains, plus a 12-hour retention, notwithstanding the usual treatment, consisting of lavage, liquid diet and HCl, it was deemed best to open the abdomen, not with the expectation of finding an ulcer, but because partial occlusion was suspected, not only of the stoma, but of the pylorus.

Operation (June 20, 1913).— The operation was a distinctly exploratory one. The appendix was found to be very ugly and chronically inflamed, but this was absolutely incidental. The intraperitoneal conditions were very chaotic, with many adhesions.

The pylorus was found patent, with no evidence of any stenosis at that point. Search for the site of the gastro-enterostomy was attended with great difficulty on account of the extensive adhesions in and about the upper abdomen.

After getting this chaos cleared up, I found an anastomosis on the posterior wall of the stomach, but instead of its being between the posterior wall of the stomach and the first portion of the jejunum, it was between the posterior wall of the stomach and the last portion of the ileum, about 20 to 24 inches from the ileocæcal valve. There was so much difficulty in finding the anastomosis and getting down to the seat of the new stoma and straightening out the adhesions, that I did not dare prolong the operation further, for fear of shocking the patient beyond repair. So I left this anastomosis as it was and simply removed the appendix, which was in marked need of removal, and closed her up with the definite understanding that she should be told of the condition and later some effort at repair be made.

The true status of the case was that since the pylorus was patent, the food contents of the stomach found their way out through this natural outlet. The small intestines were able to carry on their physiological function, in spite of this patent side-tracking stoma. Thus nourishment was kept up. This case beautifully exemplifies, or rather, corrects, erroneous ideas that some may entertain as to the movement of gastric contents after gastro-enterostomy.

The patient was told to report at regular intervals after discharge, and this she did. Although not entirely relieved, she was moderately comfortable for some weeks. At times the symptoms of vomiting and nausea were as severe as formerly. Five months after the exploratory operation, in November, 1913, she returned for readmission. At this time she was suffering almost constantly, and had lost much weight. No beds being available, she was sent to me at St. Joseph's Hospital. Again medical treatment was instituted, but with little improvement. She was sent to the operating room on December 23.

Second Operation (December 23, 1913).—I operated for the purpose of disconnecting this anastomosis between the ileum and stomach. After freeing the adhesions in the upper abdomen and getting the coils of small intestines unravelled, the anastomosis was dissected loose, and the operative procedure employed was the same as that which I make use of in doing a pylorectomy. That is, the peritoneal and muscular coats of the stomach were dissected back to the submucosa, which was clamped, ligated, severed by thermocautery, and then invaginated with purse-string sutures. The same procedure was made use of in closing

the ileum after the anastomosis was disconnected. I found that in invaginating the lateral opening into the lumen of the ileum it diminished its lumen to such an extent that I was afraid it would be impinged upon, and not be sufficiently large for the passage of the food residue. Rather than trust to it absolutely, I concluded to do an entero-enterostomy, or a lateral anastomosis, in this loop of the ileum immediately adjacent to where the anastomosis was done. This was done by the use of a Murphy button in order to save time. The abdomen was closed and uninterrupted recovery ensued (diagrammatic drawings, Figs. 1 and 2). The Murphy button was passed on the thirteenth day after the operation. She was discharged apparently in excellent health on January 21, 1914.

Later Observations.—The patient reports about twice a month. She is able to cook and do the laundry work for a family of four. She is obstinately constipated; but as a whole considers herself to be well off. At no time since she first came under observation have there been any of the classic symptoms of gastric or duodenal ulcer, either before the gastro-ileostomy was undone or since that time. Figs. 1 and 2 demonstrate the conditions before and after the gastro-ileostomy was undone and the pylorus allowed to functionate normally.

The findings and the facts noted in the above case bring up many interesting points. And among these, apart from the unusual and unheard-of point of anastomosis, the one of the most interest to me was the beautiful demonstration that I was able to give at my first operation of the stomach peristalsis. In spite of its dual openings, definite peristaltic waves continued, conducting the gastric contents to the pylorus regularly and rhythmically, notwithstanding the fact that the new stoma was still patent and sufficiently large for gastric contents to go that way. But I say, in spite of this, the definite waves of muscle contractions rhythmically progressed to the normal aperture, namely, the pylorus.

Furthermore, examination of the pylorus revealed no evidence of antral, pyloric or duodenal ulcer then present, or any indications of having been present. These facts, I think, definitely answer the question which immediately arises: If this patient's entire small intestinal tract was side-tracked off by this operation, namely, by an anastomosis being made between the posterior wall of her stomach and the last portion of her ileum, as was the case, in what way did she get nourishment sufficient to carry on life? As I have said, this question is answered by the demonstration that in spite of the new stoma, the bulk of the food

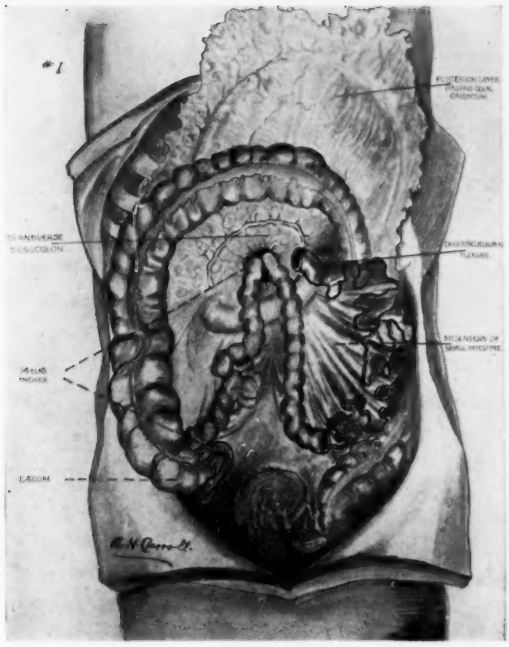


FIG. 1.—Ileum fourteen to sixteen inches from cæcum anastomosed to stomach; posterior gastro-enterostomy.

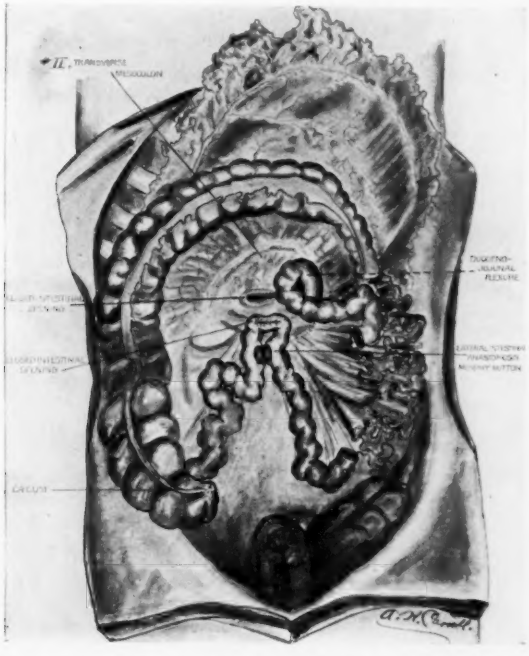


FIG. 2.—Opening in ileum closed and a lateral anastomosis done; pylorus left patent; stoma closed.

contents from the stomach must have gone on through the pylorus and down on through the small intestines, and in that way nourishment was obtained for the maintenance of life.

Now to come back to the subject, what is the rôle gastro-enterostomy plays? It has been largely conceded that many stomach and duodenal ulcers are finally considered grave enough to be classed as surgical, although the treatment offers at best a vexed and perplexing problem to both physician and surgeon. Still, what has been done with them by the surgeon in the past, has been resorted to on account of the supposedly favorable influence exerted upon these ulcers of the stomach, situated in the antrum, or at the pylorus, or in the duodenum. It has been the operation of choice, because by adopting this procedure it was thought a condition was established favorable to the healing of the ulcer. However, it has likewise been conceded that this operative procedure has had no effect upon ulcers in other localities of the organ (namely, on the lesser curvature, in the fundus, or elsewhere).

But have these favorable results following gastro-enterostomy been of lasting nature? I believe statistics show that they have not been lasting; but that, on the other hand, recurrence or recrudescence of the ulcers in and about the pylorus and the first part of the duodenum has taken place in at least 45 per cent. of the cases, and that quite a large percentage of them have later become malignant.

This, although a melancholy truth, nevertheless appears to be a fact, and therefore one naturally asks, is there no better, or more lasting, operative intervention for these very important and common conditions, which are so very far-reaching in their consequences and with such a varied array of complications, all of which are so serious in character, such as disabling contractions, obstructions, hemorrhage, perforation and malignant degeneration. Each and any one of these is of such importance as to command a chapter to itself, and thorough study for correction.

Acute perforation of gastric or duodenal ulcer is alone, by all odds, the most serious, and I might say, the most tragic disaster that can happen in the human body. No accident in surgery is more perilous nor so rarely recognized early. Does it seem reasonable then, that an operation such as gastro-enterostomy, with its easily demonstrated unscientific principles, would possibly meet and correct these serious consequences arising from stomach ulcer? And yet this has been for years the " cure-all " for almost every stomach malady that exists.

Let us discuss for a moment some of the known factors of interest

concerning the influence gastro-enterostomy has upon gastric and duodenal ulcers, and in that way try to modify the operative procedure, in order that it may be more lasting in its effects, as applied to the cure of these ulcers.

Since we do not know the etiology or exact pathogenesis, any more than we know the exact cause of cancer of the stomach, we know that with the one, which we regard as the precancerous condition of cancer of the stomach, so likewise with the other; that chronic and constant irritation is recognized as an important elemental factor in the etiology. Recently, however, many experimental workers have advanced the theory that gastric and duodenal ulcers are due to infective states of the stomach and duodenum. That given a minute or gross defect in the gastric mucosa, produced by trauma or what not, such minute or gross defects will grow into ulcerations, provided the stomach contains pathogenic bacteria.

Barclay's views and conclusions regarding the etiology are worth while, and I herewith quote the following: "Septic conditions in the mouth or other sources of swallowed septic matter, constipation, mucous colitis and a variety of other conditions are capable of producing spasmodic contractions of various parts of the stomach. The spasm produces a narrowing of the lumen that is of great functional importance, causing a definite obstruction to the passage of food. By an indiscretion of diet or want of mastication, something too large to pass easily through the channel has to be forced through by powerful peristalsis. This leads to an abrasion at the point where the lumen is narrowed and where there is the constant irritation of food passing over it. A surface is exposed that is not structurally fitted to withstand the action of the gastric juice. In this way an ulcer is formed which in its turn perpetuates the original spasm that determined the site of the ulcer. A vicious circle is established, the ulcer now being actually the cause of spasm that prevents healing, so that even if the original cause of the spasm is removed, there is little, if any, improvement in the local condition."

It seems to me that one must be fully conscious of the importance of this spasmodic element as a complication of organic lesions in this region of the stomach, and this undoubtedly is the most important keynote of the whole argument. Whether the spasm at the pylorus is the effect of the ulcer or, on the other hand, the cause of the ulcer, is a very difficult question to decide. To repeat, since we do not know their exact causation, it is difficult to state definitely just how our therapeutic agents exercise a healing influence on them.

We do know, however, that gastro-enterostomy (and we must understand by that the creation of a new opening between the anterior or the posterior wall of the stomach and the first portion of the jejunum) exercises an influence on antral, pyloric or duodenal ulcers, namely, those situated in the grinding portion of the stomach and the first portion of the duodenum, in practically only two ways: first, either by diverting or side-tracking the contents of the stomach away from the pyloric orifice into the jejunum, or second, by permitting a reflux into the stomach of the alkaline contents of the jejunum, which neutralizes the acid gastric contents. One of these means alone or both together favorably affects ulceration in these particular areas, and supposedly aids in the healing of same, but definitely has no effect upon ulcers located in other portions of the stomach, lesser curvature, fundus, or elsewhere.

Furthermore, it is pretty definitely understood that when an ulcer is situated in the pyloric region of the stomach, or first portion of the duodenum, there is accompanying it, or in consequence of it, a spastic contraction of the pyloric muscle, which is more or less constant, and in a measure partially, and in some cases completely, occludes this orifice. And in accordance with this belief it is further known that ulcers situated in other sections of the stomach have no such influence on the pylorus. Therefore, when we have this partial pyloric stenosis due to spastic contraction, in consequence of the ulcer, then the influence gastro-enterostomy has is a favorable one, and is exactly the same, and as favorable, as the effect obtained in those earlier cases of gastro-enterostomies performed for starvation, in consequence of the pylorus being organically closed by stricture or tumor.

As we all know, in these cases the results are marked and brilliant. The gastric contents no longer pass through the pyloric orifice but through the new stoma, and thus the irritation from the food, exerting a harmful effect on the ulcerated area, is done away with, because the irritating agent is diverted through the stoma. After healing of the ulcer takes place, if it does, the spasm of the sphincter muscle ceases, and the food contents of the stomach revert back to the pylorus, this now being patent for its exit, and no longer passes out through the stoma. These are surgical facts—what, then, is the consequence?

There is a prevailing opinion among the many medical and some surgical men that the stomach is a passive reservoir during digestion, and that when a new opening is created at the most dependent point of the organ, gravity alone will cause the gastric contents to pass through this new opening into the small intestines. Therefore, a gastro-enteros-

tomy has been regarded by them as a drainage operation, and the idea arose in the past that it was of paramount importance that the stoma must be placed at the lowest point of the stomach, in order to insure good drainage. In order to further aid in the accomplishment of this purpose, patients have been placed in the upright posture following operation, the operator stating that the gastric contents would more speedily gravitate through this dependent opening.

Those who have leaned closely to this idea have been unmindful of the fact of the true muscular contracting force of the stomach, which forces food contents rhythmically toward the pylorus, and that its normal physiological propelling power is directed always, as it should be, toward its own natural exit, namely, the pylorus. The drainage opening so called, or stoma, will not drain continuously or with certainty, so long as the pylorus is patent. This is clearly and graphically demonstrated by the findings in the above case, and from a study of the accompanying X-ray series presented later.

Cannon ingeniously offers valuable conclusions on this subject in his book on the " Mechanical Factors of Digestion," and clearly points out that the stomach is not at any time during digestion in the condition of a passive reservoir. He states: " The cardiac end is exerting a positive pressure, and so long as food is present the pyloric end is the seat of continuous peristalsis, and if the pylorus is patent, these waves of peristalsis direct the food contents to this natural opening, even though there be a stoma, and gastro-enterostomy being a drainage operation is, therefore, out of the question." It has been experimentally proven that the hydrostatic conditions in the abdominal cavity are such that gravity drainage from the stomach is impossible. As a proof of this last statement, it has been experimentally shown that " when a gastro-anastomosed stomach is filled with water, the latter does not run out of itself, even though the animal is in an upright position, and, as has been clearly pointed out by Kelling, Cannon and others, it is an important fact to bear in mind that material never moves along any part of the alimentary canal unless the pressure is greater on one side of it than on the other. Furthermore, it has been shown that the chyme always takes its normal course through the pylorus, if the latter is patent, rather than through any artificial opening."

The conclusions, therefore, may be justly drawn that if the pylorus is patent, the gastric contents are forced out through this natural opening, even though portions at times also pass through the anastomosis. It is only when the pylorus is definitely closed that the entire contents of the stomach pass through the anastomotic opening into

the jejunum. This, it seems to me, is the main factor in determining the influence that gastro-enterostomy exerts on gastric ulcers. By the spasm at the pylorus the gastric contents are diverted away from the ulcerated area. But, as Cannon wisely states, "We should not deceive ourselves by the supposition that the operation permits this region to enjoy entire relief from the peristalsis and the undue muscular activity in consequence of it, or the marked hyperacidity which is present in many of these cases." Relief and help does come in this way, and also by the reflux of the alkaline juices from the jejunum; this is conceded to be a fact, and, furthermore, is clinically noted shortly following the operation of gastro-enterostomy.

After healing takes place, the spasm of the pyloric sphincter muscle relaxes. The pylorus again becomes patent, and the stomach contents no longer freely pass through the new anastomotic orifice, but revert back to the patent pylorus. But we must always remember that the etiological factors may remain. Is it, then, any wonder that there is such a high percentage of recurrences? At least one of the accepted original causes of the ulcer returns. The trauma that exerted itself at the pyloric orifice again takes place, the stoma frequently has closed in a measure, and then, even when it could again be of service, it ceases to afford an exit for the stomach contents. The old ulcerated area is very likely to start into activity again. These two factors, namely, the new stoma and the neutralizing effect of the gastric content, do not stay the muscle contractility, and therefore do not put it completely at rest, which is so important a factor in healing. I believe the neutralizing effect is not sufficient in itself to be of marked utility. Therefore, we may conclude that gastro-enterostomy can accomplish good only in such ulcers as are situated near the pylorus, an area which constitutes four-fifths of the ulcer-bearing surface of the stomach.

Barclay and Cannon along with Hertz, whom both quote, have given a deeper insight into the mechanics of digestion than most of the others put together. Naturally, the surgeon, in dealing with the pathological conditions which he encounters, must base his efforts upon the primary physiological and mechanical facts which have been established.

To sum up, from the surgical point of view, I would say: First, that gastro-enterostomy is of value only in pyloric and duodenal ulcers attended with pyloric spasm, and is not always of lasting effect. Second, it can be of no value in ulcerations situated in other parts of the organ, although the symptom of hyperacidity is markedly relieved in many of the cases by it. Third, when the pylorus becomes patent, the artificial stoma tends to contract and close, and there is

present a tendency for the reformation of the ulcer. Fourth, is it not worth while, under these circumstances to adopt a means which may be of more lasting effect and unattended by this high percentage of recurrence?

The high percentage of recurrences, the serious and ever-present complications, and the tendency to malignant degeneration, which is far more common than hitherto suspected, warrant, in my judgment, a more radical and efficient method than is offered by gastro-enterostomy alone. Gastro-enterostomy does not offer permanent relief in preventing these complications.

Statistics show that in 70 per cent. of the cases of cancer of the stomach there is a precancerous history of ulcer. These facts alone seem to me to warrant excision of the ulcer-bearing area, and in all cases the operation of pylorectomy offers a greater promise of success than any other operative procedure that we have at our command. The consensus of opinion to-day is that the ulcer-bearing area should be removed, and it is best removed by pylorectomy. But the criticisms causing it not to be in wide-spread favor are that it is attended with too high a mortality. This mortality is given as from 12 to 15 per cent., whereas the mortality attending gastro-enterostomy is given as 1½ to 2 per cent. I feel that this is an unfair criticism of the procedure, and it appears to me that the mortality that is given is out of all proportion and entirely too high. I further believe that the operation of pylorectomy should be done in such a way as to have the mortality no greater than that attending gastro-enterostomy.

In my own service the mortality attending pylorectomy has been less than the mortality attending gastro-enterostomy. The few cases that I have recently done for ulcers (five in all) have been unattended with mortality, and the surgical recovery was unattended by any serious disturbance. The greatest proof of the wisdom of this operative procedure in these few recent cases has been that in three out of the five the report from the microscopic findings was that of "beginning malignancy." This, I think, speaks more forcibly for the operative procedure than anything I know of.

The operations of pyloric occlusion which have been suggested by numerous operators are inefficient and unscientific, and in no way are to be rationally considered. Such an occlusion as devised by von Eiselberg, namely, by completely dividing the stomach from the duodenum and suturing the two ends, seems to me to offer nothing that is to be commended. The mortality would probably be quite as high as in a definite pylorectomy, and, furthermore, it offers no protection to

the patient from this oncoming possibility of malignant degeneration. Therefore, as gastro-enterostomy alone cannot meet the requirements, in that it does not combat the tendency to malignant degeneration, it should play but a partial rôle in the treatment of gastric ulcers.

There is one condition in which gastro-enterostomy may still be considered the operation of choice: in those cases of benign stenosis where the lumen of the pylorus has been almost entirely occluded and is permanent in character. These cases seek relief from starvation, and are markedly helped by gastro-enterostomy.

Finally, pylorectomy meeting the various requirements, protecting against recurrence of the ulcer, eliminating the possibilities of complications, and removing definitely that chief source of carcinoma, seems to me to merit more definite recognition.

ACTIVITY OF THE PYLORUS FOLLOWING GASTRO-ENTEROSTOMY.

In accordance with Dr. Martin's suggestion that there be gathered photographs of some cases upon which gastro-enterostomies and pylorectomies plus gastro-enterostomies, have been done, twenty cases have been reviewed, in which the patient has been serially photographed following gastro-enterostomy. In two of the cases the pylorus had been excised.

In none of these cases was the pyloric outlet found to be obstructed by scar tissue formation or from adhesions, at operation. In all of them the ulcer was in the " ulcer bearing area," and in all the symptoms had disappeared. Any case which exhibited symptoms would not have demonstrated the normal post-operative functioning of the pylorus and stoma.

The point of greatest interest is whether the pylorus is relieved of its duties once the new opening has been established. It appears from a study of these cases, personally at least, that there is really clear and incontestable evidence that the major portion of the work of emptying the stomach is performed by the pyloric gateway, if this is unobstructed and patent.

In the normal subject, it is not easy to see the bismuth which has passed through the pylorus and on into the loop of the duodenum, and this is due to the very small quantities allowed to pass at a time. It passes in very finely divided masses, and casts such a faint shadow that in order to " get " this in the X-ray plate, a very rapid tube must be used.

That portion of the bismuth meal which passes through the stoma

is not finely divided and at first is composed of comparatively large masses. This is exactly what one would anticipate and to which attention has been previously called; but unless this is borne in mind it will appear to the casual observer in viewing a series of plates taken following gastro-enterostomy, that all the bismuth is leaving by the stoma.

In the "immediate plate," bismuth is seldom seen in the duodenal loop in normal cases. Time must elapse before the reflex activities, which control the opening and closing of the pyloric sphincter, allow any bismuth to pass. But exactly the opposite is true of the stoma or new hole which has been made in the wall of the stomach. This hole is opened at once when a distending meal is introduced, since there is a stretching of the wall, and normal tonicity has not had time to become established. The result is that there is always a distinct shadow seen in the immediate plate extending into the intestine through the stoma.

However, in the study of this series, bismuth was seen in the loop of the duodenum in the *later plates* in every case, while evidence of the rapid exit through the stoma is lacking, although at times even in the later plates the stoma does afford a generous outlet.

Barclay and many others have called attention to this, and some think that later the stoma becomes endowed with a certain control over the exit of the gastric contents. I have not observed this. It appears more reasonable to suppose that later the major portion of the work is done by the pylorus, and that only occasionally is there a rush of contents through the stoma, during the intervals, perhaps, between vigorous peristaltic waves, and when the pylorus is not physiologically ready to open.

The question is not merely an academic one, if we consider irritation and trauma as etiological factors in ulcer. If the X-ray plates shown serve to demonstrate graphically in man, that the pylorus will continue to functionate, notwithstanding the presence of the stoma following gastro-enterostomy for ulcer, the operation of pylorectomy may appear to some, who have not decided the question fully for themselves, to have a greater value as a procedure in the surgical treatment of ulcer at or near the pylorus.[1]

Series No. 1.—These plates are of a case in which a pylorectomy was done. It is interesting to note the normal position of the stomach, in contrast to the

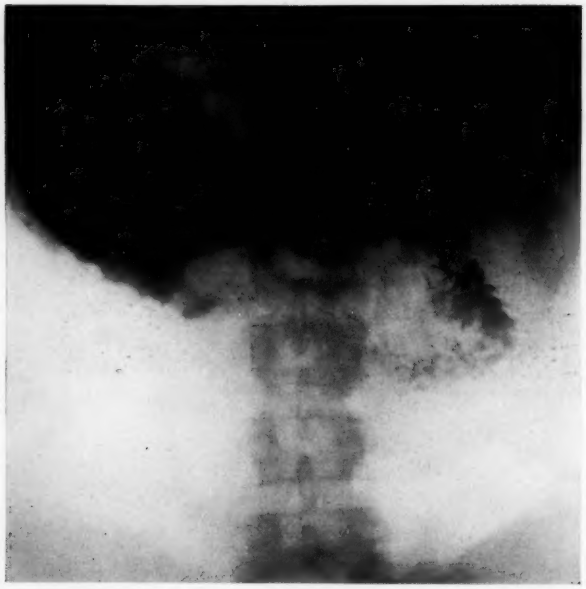
[1] The passage of bismuth through the pylorus, although clearly demonstrated in an X-ray plate, in reproduction first in the printed photograph and later in the engraving, loses much in detail, so small is the amount and faint the shadow in normal cases. Retouching or strengthening the print would render it of negative value.

FIG. 3.—Series No. 1. Case 4090. Gastro-enterostomy plus pylorectomy. Twenty minutes after a small bismuth meal—the bismuth is leaving freely by the stoma. The jejunum is filling rapidly. There is no evidence of a dragging at the site of the stoma, as in many instances where gastro-enterostomy alone has been done. The outline of the stomach is regular and normal in shape and position, with the exception of the "filling defect" at the pyloric end, where the invagination of the prepyloric portion was done in closing the opening after pylorectomy.

FIG. 4.—Series No. 1. Case 4090. Taken one hour after Fig. 3. The stomach is nearly empty. Bismuth masses well along towards the cæcum. (The first plate in this series was similar to Fig. 3, but did not tell the story so graphically as Fig. 4.)

FIG. 5

FIG. 6.



FIGS. 5 and 6.—Series No. 2. Case 4027. Gastro-enterostomy. Operation five years ago for duodenal ulcer(?); new ulcer. These plates were taken without a previous bismuth meal and at short intervals. Notice the rapid filling of the jejunum in both plates. The pyloric end of the stomach appears drawn to the right by perigastric adhesions. The first bismuth liberated from the stomach through the stoma (Fig. 5) passes on rapidly, and is seen in the pelvis in Fig. 6, while in this plate the distended prepyloric portion and the completely relaxed sphincter allow a rapid evacuation of bismuth into the duodenum.

FIG. 7.—Series No. 2. Case 4027. A spasm has shut off the progress through the duodenum, temporarily.

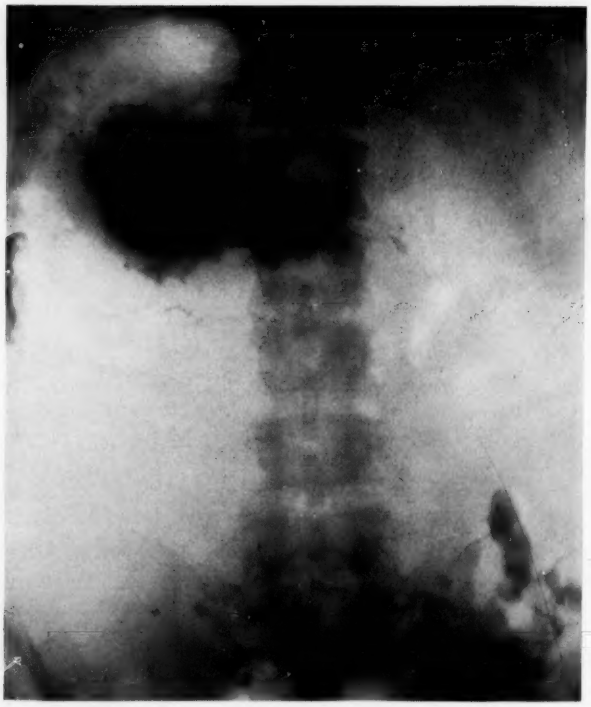


FIG. 8.—Series No. 2. Case 4027. The hour-glass condition, due to the operation, persists.

distortion, particularly of the pyloric end of the stomach, in many of the cases in which gastro-enterostomy alone has been done. There is no evidence of a dragging at the site of the stoma. The outline is unusually symmetrical and normal, with the exception of the filling defect caused by the invagination of the prepyloric portion, following the operation. The bismuth meal is seen to be leaving in an even manner and well distributed along the small intestine. The second plate (Fig. 4) taken one hour later, shows the stomach nearly half empty, and the bismuth well on its way to the cæcum (case No. 4049).

In series No. 2, in which a gastro-enterostomy alone has been done, it will be noticed in the first plate (Fig. 5), taken immediately after a bismuth meal, without a "previous meal," that there has been a rush of content into the intestine through the stoma, while the gastric peristalsis has carried the bismuth beyond the prepyloric region, and has formed a well defined "bishop's cap." Nothing has as yet entered the duodenum *via* the pylorus, nor has there been any backing up, against the normal peristaltic duodenal waves of contraction, of material which might have entered the tube through the stoma. In the second plate (Fig. 6), however, the first gush of bismuth laden meal has dissipated itself along the small intestine, while the duodenum is seen to be laden with bismuth which has entered through the pylorus. The prepyloric portion is greatly distended with material which gastric peristalsis has brought there and which is ready to rush into the duodenum when the pylorus opens during the systole of the next gastric cycle. In the third plate (Fig. 7) of series No. 2, the gastric content appears to be quietly making its exit through the pylorus, and none is seen to be passing onward through the stoma. The gastric wall is pulled over towards the pyloric end, at the site of the stoma. This is not unusual and is no doubt the cause of a kink or angulation in the duodenojejunal region which partially obstructs the lumen of the tube, and results at times in the backing up into the stomach of duodenal secretions, with vicious circle and vomiting.

Lewis Gregory Cole, whose cinematograph pictures of the bismuth-laden stomach and intestines have demonstrated so graphically the normal and pathological functioning of these organs, has recently told me definitely that his studies have demonstrated the persistence of pyloric functioning. The facts shown by these röntgenological studies appear sufficiently definite to permit again calling attention to a phenomenon readily accepted by many, but persistently disregarded and even unknown to a large number of physicians and surgeons.

Conclusions.—It can be shown radiographically that in man, as well as experimentally in animals, a patent pylorus tends to functionate notwithstanding the presence of a patent stoma. That gastric contents will leave *via* the stoma, and at first in large quantity, but that it is not a fact that the egress continues rapidly later.

THE PATHOGENESIS OF UMBILICAL HERNIA

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Introduction.—The impulse for this study arose from an invariable phenomenon observed in umbilical herniæ, namely, that despite a fairly large hernial protrusion, an umbilical depression is still present.

In numerous articles the writer has repeatedly called attention to the importance of the transversalis fascia and blood-vessels in the pathogenesis of inguinal and femoral herniæ. As I shall demonstrate, the same factors hold true in the pathogenesis of umbilical hernia.

Pathogenesis.—It is customary to divide umbilical herniæ into three different groups: (1) Herniæ into the umbilical cord; (2) umbilical herniæ of children; and (3) umbilical herniæ of adults. A hernia into the umbilical cord is, however, a congenital malformation, and in no sense of the word a hernia; there is no valid reason, therefore, why this malformation should be included in a discussion of umbilical hernia. On the other hand, umbilical herniæ of children and of adults are identical, both on theoretical and practical grounds. They are certainly the same both from an anatomic and pathologic view-point. It is true that an umbilical hernia in children is more amenable to non-operative treatment than the adult variety; but this is hardly a sufficient basis upon which to make a special classification. Furthermore it is more than probable, in spite of assertions to the contrary, that an umbilical hernia in an adult had its origin in early infancy.

In order to more readily understand the development of an umbilical hernia, it is necessary to again recall certain general facts of fundamental importance in the pathogenesis of every hernia. These are the following:

1. That, with certain exceptions, namely where the viscera or their mesenteries find their attachment, the abdominal parietes are lined throughout by peritoneum.

2. That externally to the peritoneum, and separated from it merely by the more or less developed properitoneal fat, there is everywhere a continuous layer of a strong fascia. This fascia has received different names in different parts of the abdomen, depending upon the particular anatomical location; but in this connection the only particular point to

remember is, that it is only one, and a continuous layer. For the sake of simplicity it will be called " transversalis " fascia.

3. That all the vessels which escape from or run into the abdomen lie between the peritoneum and the transversalis fascia.

4. The last statement being true, it also follows that before a vessel can escape from or enter the abdomen, there must be an opening in the transversalis fascia, *e.g.*, the internal inguinal ring, or internal femoral ring.

5. These openings in the transversalis fascia are not bounded by an abruptly terminating sharp edge. At the point of exit of the vessel, the transversalis fascia becomes everted, and is prolonged on to the vessel in the form of an adventitious covering, finally blending with the wall of the vessel itself. This is excellently demonstrated in the so-called infundibuliform fascia, and sheath of the femoral vessels.

6. These openings in the transversalis fascia are places of lesser resistance in the abdominal wall, and in consequence are the only locations through which hernial protrusions occur.

7. The aforementioned prolongations of the transversalis fascia form one of the coverings of the hernia.

These seven anatomic principles have, I believe, been abundantly proven in my previous publications upon the subject. It remains merely to be shown how far they apply to umbilical hernia.

Before proceeding, however, with this discussion, it is essential to first describe the development and anatomy of the normal umbilicus. In many respects the development and anatomy of the umbilicus, while apparently very simple, is in reality far more complicated than, for instance, that of inguinal hernia, owing to the number of structures which pass through it during fetal life.

It is unnecessary for our purpose to discuss the earliest development of the embryonic membranes; we shall begin at the period when the umbilical cord and urachus are already formed. The urachus passes from the inferior margin of the umbilical ring perpendicularly downward to the vertex of the bladder. The two umbilical arteries also pass downward, but slightly diverging from each other, to the lateral aspects of the bladder. The single umbilical vein passes from the upper part of the umbilical ring backward and upward, and slightly also to the right, into the round ligament of the liver.

At birth there is usually an extension, for a short distance, of the skin epithelium over the umbilical cord; the cutaneous margin diminishing in an irregular wavy line. Directly after birth the stump of the umbilical cord, which had been ligated one or two inches distally from

its abdominal insertion, begins to necrose, and is usually cast off within five to seven days, leaving behind a small granulating surface, or what may be termed at this stage the " umbilical ulcer." This umbilical ulcer is slightly elevated above the surrounding integument. In the subsequent course healing of the shallow ulcer takes place, by the epithelium from the surrounding skin margins growing over it; and when healing is completed, the umbilicus is a slightly depressed cicatrix. Coincident with these changes other more important and more complicated changes have taken place in the depth. The three vessels which enter into the formation of the umbilical cord become thrombosed after ligation; this thrombosis, moreover, extends up to the first collateral branch, as usually occurs in the surgical ligation of any vessel. The two umbilical arteries thus become converted into the two obliterated hypogastric arteries, and finally form the two lateral superior ligaments of the bladder; while the umbilical vein enters into the formation of the round ligament of the liver.

The final change through which this ultimate end result is obtained is still a matter of doubt and controversy. According to some observers the process is merely one of thrombosis, organization of the thrombus and subsequent retraction; but Herzog (*Die Rückbildung des Nabels und der Nabegefässel.* München, 1892) in a very laborious and apparently convincing study shows that the process is not quite so simple, and is more in the nature of a degenerative process, because the muscular coat eventually disappears from the obliterated parts of the vessel.

Herzog also has shown for the first time, that coincident with this stage, or already during intra-uterine life, other changes occur, which are particularly well marked in the umbilical arteries. During fetal life the adventitia of these vessels is particularly strongly developed, and when the circulation has ceased within the lumen, this coat contracts and retracts, thereby fastening these vessels firmly to the inferior margin of the umbilical ring and against the anterior abdominal wall. The presence of such an extraordinary large amount of embryonal connective tissue fills the lower portion of the umbilicus with a firm layer of tissue, which, in conjunction with other factors to be later described, acts as an efficient barrier against the development of a hernia at this point.

The umbilical vein, however, does not possess so well-developed an adventitia; the changes just described for the umbilical arteries, therefore, do not take place, or only to a very limited degree. The result is, that there remains constantly a more or less developed hiatus between

the obliterated vein and the upper margin of the umbilical ring. Upon theoretical grounds we should expect to find such a weak spot also inferior to the vein; in fact, however, we do not find such a hiatus, and for the following reasons: The umbilical ring is very small; and in this limited space there occurs a firm union between the terminations of the two umbilical arteries and the vein, which tends, on the one hand, to obliterate the weak area inferior to the vein and, on the other hand, to enlarge the opening superior to the vein still more.

In early fetal life the lumen of the bladder communicates with the urachus. Later the lumen of the urachus becomes obliterated, and is represented by a cord-like structure; even the musculature disappears, except at its vesical attachment.

Surgical Anatomy.—For practical purposes the umbilicus may be regarded as a hiatus in the linea alba. Its surgical anatomy may in consequence be more readily understood if the anatomy of the linea alba in its immediate neighborhood is studied.

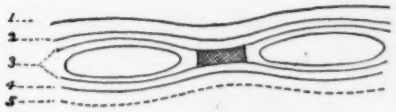

Fig. 1

FIG. 1.—Diagrammatic cross-section of linea alba. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum.

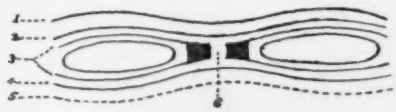

Fig. 2

FIG. 2.—Diagrammatic cross-section of umbilicus in its simplest form. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical opening.

The linea alba is a fibro-aponeurotic structure placed in the midline of the abdomen, and is formed by the coalescence and interlacing of the sheaths of the recti on either side. It is of some importance to remember, that neither the superficial fascia, nor the transversalis fascia, nor the peritoneum enter into the formation of the linea alba, all these structures passing freely from one side of the abdomen to the other. A purely diagrammatic cross-section of this region would therefore have the appearance as shown in Fig. 1.

It has frequently been mentioned that the umbilicus may be regarded as a hiatus or defect in the linea alba; reduced to its simplest form the umbilicus may therefore be represented as in Fig. 2.

At the location of this defect in the linea alba all the structures in the vicinity undergo a certain amount of alteration.

1. The skin is not continuous, as it is represented to be in the preceding diagram (Fig. 2), because at the centre of the umbilicus the skin is replaced by cicatricial tissue, caused by the healing of the umbilical ulcer.

For the same reason also, the subcutaneous fat ceases at the margins of the umbilical ring; so that the cutaneous cicatrix becomes adherent directly to the underlying superficial fascia. The umbilicus is frequently spoken of as the umbilical depression, but this depression is only an apparent one, because in reality the umbilicus is on a level with the structures composing the linea alba. Its apparent depression is due merely to the absence of subcutaneous fat at the umbilicus; the more this surrounding layer of subcutaneous fat is developed, the deeper the umbilicus will appear to be, and *vice versa.* At this stage of our description Fig. 3 would be a correct diagrammatic representation of the umbilicus.

2. For didactic purposes the description of the anatomy of the superficial fascia will be reserved until after the deeper anatomical structures have been described.

3. The peritoneum is directly continuous from one side to the other.

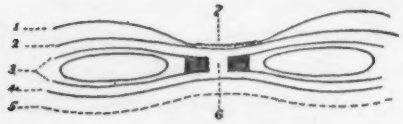

Fig. 3

FIG. 3.—Diagrammatic cross-section of umbilicus showing the umbilical cicatrix. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical opening; 7, umbilical cicatrix.

Fig. 4

FIG. 4.—Diagrammatic cross-section of umbilicus showing Richet's fascia. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, Richet's fascia.

At the superior margin of the umbilicus the peritoneum is reflected, in order to enter into the formation of the round and falciform ligaments of the liver. Well within the confines of the umbilical ring the peritoneum is slightly puckered up, and is also intimately adherent to the underlying transversalis fascia.

4. The transversalis fascia is fundamentally a continuous layer extending from one side of the abdomen to the other. It is a curious fact, and at the same time a wise provision of nature, that at the location of the umbilicus (an obvious place of diminished resistance) this portion of the transversalis fascia is especially strong. Attention to this point was first drawn by Richet (*Archives Generales de Médecine,* December, 1856; January, 1857) who found, in numerous dissections, that, in a large majority of the cases, this portion of the transversalis fascia is materially strengthened by transversely running interlacing fibres. This increased strength is so pronounced that he deemed this portion of the transversalis fascia worthy of a name, and he calls it the " umbilical

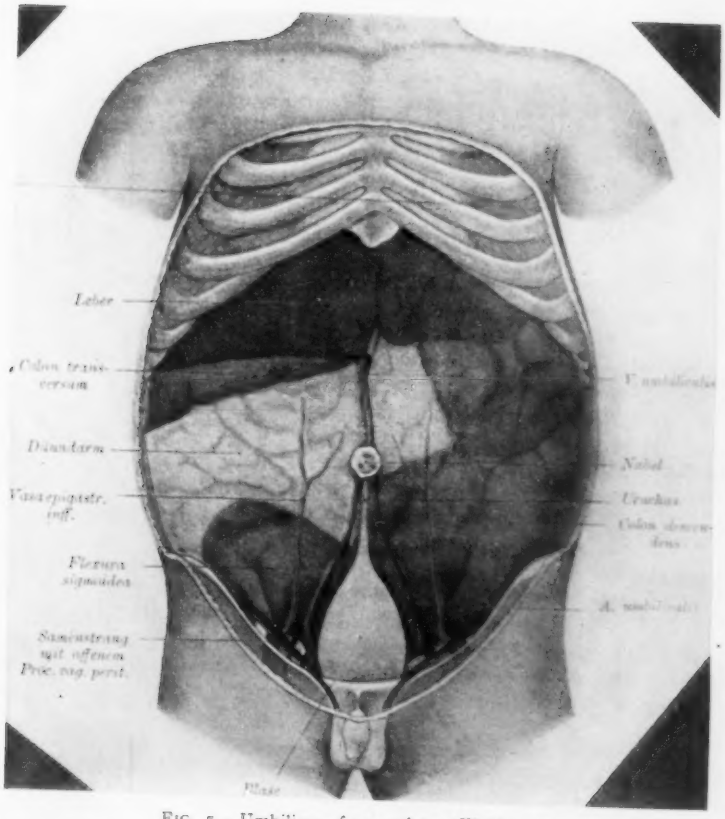

FIG. 5.—Umbilicus of a new-born (Waldeyer).

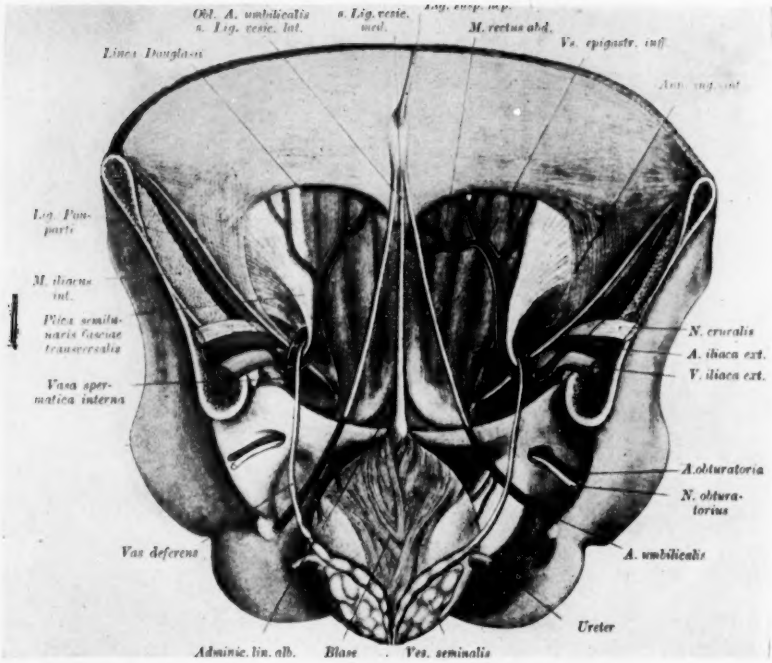

FIG. 7.—Posterior view of anterior abdominal wall (Waldeyer).

fascia." The extent of this fascia, both in a vertical and horizontal direction, varies within wide limits. Its tensile strength is so great, that were it not weakened by the passage of vessels and other fetal structures, the umbilical fascia would be ample to withstand any increase in the intra-abdominal pressure. It must again be emphasized that the umbilical fascia is not an extra layer placed here by nature, but simply a more highly developed portion of the transversalis fascia. It is rather difficult to present diagrammatically the presence of Richet's fascia; an attempt has been made in Fig. 4.

Finally, it is necessary to show the relationship of the umbilical vessels and urachus to the umbilicus and the various fascial layers of which it is composed. Because of the diversity, number, and divergence

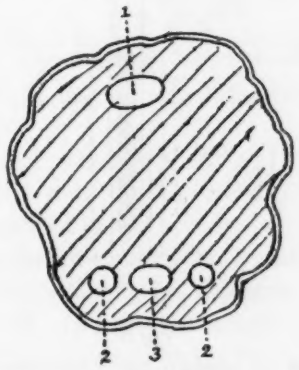

Fig. 6

FIG. 6.—Diagrammatic anterior view of umbilicus. 1, umbilical vein; 2, umbilical arteries; 3, urachus.

of these structures, the problem is not a simple one. For didactic purposes it appears best to first construct an umbilicus, and then to view it from different aspects.

Fig. 5 shows after Waldeyer an anterior view of the abdomen of a new-born child, with removal of the entire anterior parietes, with the exception of the peritoneum. The umbilicus and the structures entering it have been retained.

Fig. 6 is an enlarged anterior view of the umbilicus diagrammatically presented, the shaded area representing Richet's fascia.

Fig. 7 shows after Waldeyer a posterior view of the anterior abdominal wall. Particular attention is called to the two obliterated umbilical arteries, the umbilical vein, and urachus, and their junction at the umbilicus.

Fig. 8 shows a cross-section of the umbilicus in a vertical direction. The principal object of the last diagram (Fig. 8) is to illustrate the so frequently reiterated point, that all the vessels are situated between the peritoneum and the transversalis fascia. Such being the case, it

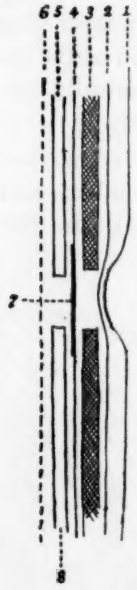

Fig. 8

FIG. 8.—Vertical section of the umbilicus before the vessels have pierced the transversalis fascia. 1, skin; 2, superficial fascia; 3, linea alba; 4, transversalis fascia; 5, umbilical vein; 6, peritoneum; 7, Richet's fascia; 8, urachus.

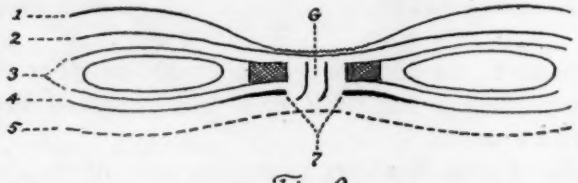

Fig. 9

FIG. 9.—Horizontal section of the umbilicus in the upper part. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical vein; 7, opening in Richet's fascia.

follows, that before the umbilical vessels can reach the placenta, they must perforate the transversalis (Richet's) fascia. It has previously been shown that the vessels leave or enter the umbilicus only at two levels, namely, the umbilical vein superiorly, and the two umbilical arteries and urachus inferiorly. A section of the umbilicus would therefore materially vary, depending upon the level and direction of the particular section.

A horizontal cross-section through the upper part of the umbilicus would therefore have the appearance as shown in Fig. 9. Note the single hole in the transversalis (Richet's) fascia made by the passage of the umbilical vein.

A similar section through the centre of the umbilicus, *i.e.*, where it is not pierced by any vessel, will appear as illustrated in Fig. 10.

A horizontal cross-section through the lower part of the umbilicus, *i.e.*, at the level where the transversalis (Richet's) fascia is pierced by

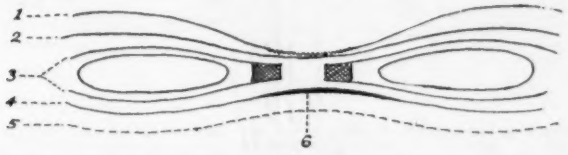

Fig. 10

FIG. 10.—Horizontal section through the centre of the umbilicus. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, Richet's fascia.

the two umbilical arteries and the urachus, will appear as illustrated in Fig. 11.

And finally a section through the centre of the umbilicus in a vertical direction, being pierced only by the umbilical vein and the urachus, would appear as illustrated in Fig. 12.

Figs. 9, 11 and 12 are intended to show more particularly the hiatus in the transversalis (Richet's) fascia, wherever it is pierced by a blood-vessel or other structure. In previous articles I have frequently emphasized the fact, that such a hiatus exists in the fascia, when and wherever

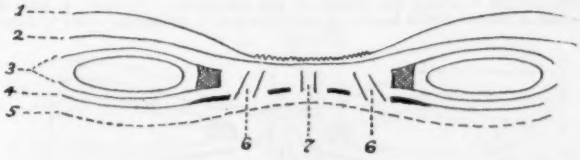

Fig. 11

FIG. 11.—Horizontal section through the lower part of the umbilicus. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical arteries; 7, urachus.

it is pierced by a blood-vessel; but in addition I have also pointed out the fact, that such a hiatus does not exist as a hole with sharply defined margins, because at the exit of a vessel the transversalis fascia becomes everted, passes outward with the vessel, and becoming more and more attenuated, it finally merges with the wall of the vessel. Therefore in order to be correct Figs. 9, 11 and 12 would have to be modified as in Figs. 13, 14 and 15. Slight reflection will show the analogy to the infundibuliform fascia and sheath of the femoral vessels. No alteration

is necessary in Fig. 10, as at that particular level the transversalis fascia is not pierced by any vessel.

Umbilical hernia differs in one special point from every other hernia; namely, that whereas in every other hernia the superficial fascia is merely stretched over the hernia, in umbilical hernia the superficial

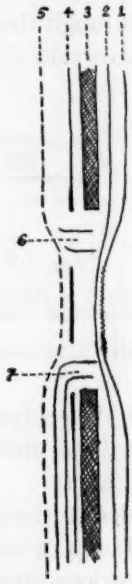

Fig. 12

FIG. 12.—Vertical section through the centre of the umbilicus. 1, skin; 2, superficial fascia; 3, linea alba; 4, transversalis fascia; 5, peritoneum; 6, umbilical vein; 7, urachus.

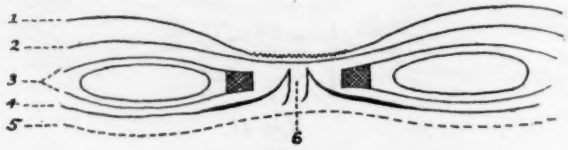

Fig. 13

FIG. 13.—Horizontal section through the upper part of the umbilicus, showing outward prolongation of Richet's fascia upon the umbilical vein. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical vein.

fascia is in addition pierced by the blood-vessels which pass through the umbilicus. This comes about because the umbilicus is the only hernial aperture whose vessels no longer functionate, and which vessels actually leave the body to reach the placenta. During the passage of the vessels through the superficial fascia, this structure, just as the transversalis fascia, also becomes everted, and becomes united to the vessels. When

the cord drops off there remains behind the so-called umbilical ulcer, the base of which is made up of superficial fascia, the stumps of the various structures which pass through it, and the small everted portions of the superficial fascia. After healing the resulting cicatrix lies directly upon and is adherent to these structures.

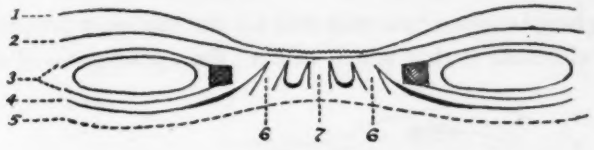

Fig. 14

FIG. 14.—Horizontal section through the lower part of the umbilicus, showing the outward prolongation of Richet's fascia upon the urachus and umbilical arteries. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical arteries; 7, urachus.

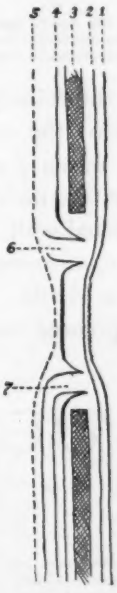

Fig. 15

FIG. 15.—Vertical section through the centre of the umbilicus, showing the outward prolongation of Richet's fascia upon the umbilical vein and urachus. 1, skin; 2, superficial fascia; 3, linea alba; 4, transversalis fascia; 5, peritoneum; 6, umbilical vein; 7, urachus.

In order to illustrate these data Figs. 13, 14 and 15 require the modifications as illustrated in Figs. 16, 17 and 18.

If these illustrations are carefully studied, it becomes evident that theoretically it is possible to have a large variety of umbilical hernia.

1. A hernia through the opening for the right umbilical artery.
2. A hernia through the opening for the left umbilical artery.

3. A hernia through the opening for the urachus.

4. A hernia through the opening for the umbilical vein.

5. In the absence of a well-developed Richet's fascia, or when it is destroyed by pathological processes, we may have a hernia through the centre of the umbilicus; such a hernia indeed would be a true umbilical hernia.

In practice, however, we find that by far the most frequent variety of umbilical hernia is that which utilizes the opening for the umbilical

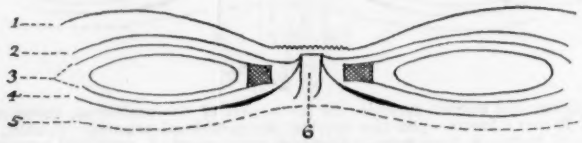

Fig. 16

FIG. 16.—Horizontal section through the upper part of the umbilicus, showing the outward prolongation of Richet's fascia and of the superficial fascia upon the umbilical vein. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical vein.

vein for its exit. This is due to the following reasons: It has previously been shown that after ligation of the cord there is formed from the abundantly present embryonal tissue a mass of very firm connective tissue, which not only binds the two umbilical arteries and the urachus to the umbilical ring and abdominal wall, but also fills up the interstices between them; this is, therefore, an opening so well protected as to be only exceptionally causative of a hernia.

Furthermore, it was also pointed out, that the umbilical vein is

Fig. 17

FIG. 17.—Horizontal section through the lower part of the umbilicus, showing the outward prolongation of Richet's fascia and of the superficial fascia upon the urachus and umbilical vein. 1, skin; 2, superficial fascia; 3, sheath of rectus; 4, transversalis fascia; 5, peritoneum; 6, umbilical arteries; 7, urachus.

deficient in this strong connective-tissue formation; indeed, the vein is being constantly pulled away from the upper margin of the umbilical ring by its attachment to the two arteries and urachus, so as to leave this portion of the linea alba practically unprotected. Even if no hernia is present the concave upper margin of the umbilical ring can frequently be palpated. This condition, so to say, invites the formation of a hernia; a fact well known already to Richet, who, for analogy's sake, called this part of the umbilicus the umbilical canal.

A vertical section of the most frequent form of umbilical hernia would therefore be represented as in Fig. 19.

The coverings of such an umbilical hernia therefore are: (1) Skin; (2) subcutaneous fat only in the upper part, none in immediate relationship with the hernia; (3) greatly attenuated superficial fascia; (4) greatly attenuated transversalis (Richet's) fascia; (5) peritoneum. Owing to the great thinness of these structures, practically all these layers are fused together.

Fig. 18

FIG. 18.—Vertical section through the centre of the umbilicus, showing the outward prolongation of Richet's fascia and of the superficial fascia upon the umbilical vein and urachus. 1, skin; 2, superficial fascia; 3, linea alba; 4, transversalis fascia; 5, peritoneum; 6, umbilical vein; 7, urachus.

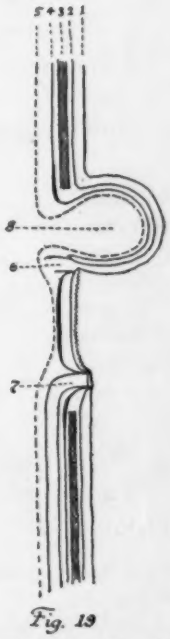

Fig. 19

FIG. 19.—Vertical section of the most frequent form of umbilical hernia. 1, skin; 2, superficial fascia; 3, linea alba; 4, transversalis fascia; 5, peritoneum; 6, umbilical vein; 7, urachus; 8, sac of umbilical hernia.

The writer does not intend to convey the impression that the anatomy and pathogenesis of umbilical hernia, as elucidated above, is of profound practical importance. The majority of the structures, as in inguinal or femoral hernia, are ruthlessly removed in the operation; indeed, to a greater degree. This is no reason, however, why the anatomy and pathogenesis of umbilical hernia should not be as carefully elaborated, as, for instance, the anatomy and pathogenesis of inguinal hernia. Up to the present, however, such intensive consideration has not been accorded to umbilical hernia.

CYSTIC DILATION OF THE VERMIFORM APPENDIX

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Cystic dilatation is a rare form of appendix disease. This disease has been designated by a number of different terms, as hydrops of the appendix, mucocele of the appendix, myxocele of the appendix, pseudo-myxomatous cyst of the appendix, cystic appendix disease, etc. However, the original pathology for this condition is the same and various terms applied to it represent the different authors' terminology. In reviewing the literature, the following is compiled from post-mortem reports of various authors:

Observer	Postmortems	Cases
Ribbert	400	6
Bryant	124	1
Steiner[1]	2286	3
Brody	528	1
Boston City Hospital	3770	16
Stengel	2000	1
Heineck	3550	0
Castle	500	0
Total	13158	28

This gives a total of 13,158 post-mortem records, in which 29 cases of cystic dilatation of the appendix were observed, or about .2 per cent.

Stengel[2] in 1906 has given a very comprehensive review of the literature, in which he collected a total of 28 cases. He also reported his case in detail, which was revealed at autopsy in a 50-year-old woman, who died of diabetes. The appendix was 6 cm. long and about 2.5 cm. in diameter. The entire wall and mucosa were atrophic. The contents was grayish-white, gelatinous material, which, upon chemical analysis, was shown to be pseudomucin, containing calcareous deposits.

J. A. Kelly[3] in 1909 has also contributed a very valuable article on this subject. In addition to Stengel's 28 cases, he was able to collect from the literature 43 cases, bringing the total up to 71. He also gives a very complete bibliography. His case was revealed at postmortem in a 43-year-old colored woman. The appendix was banana-shaped and measured 30 cm. along its greater curvature. The contents consisted of grayish, jelly-like pseudomucin. The following is taken from Kelly's report and is the résumé of the cases from the literature:

"A summary of the cases found in the literature and that of the author, in all 68 cases, shows the following facts: 33 cases were observed at the operating table, 18 were found at autopsy, and in 17 the method of observation is not recorded. Of the 33 cases observed at the operating table there were symptoms of appendicitis in 20. In 13 cases the cyst of the appendix was found during the

course of operations upon other structures. Of these 13 cases, 4 were present in hernial sacs, and 2 were associated with ovarian cysts. Of the 68 cases, 9 were found in males, 8 in females, and in 51 the sex is not recorded. The cyst included the entire appendix in 11 cases, it was localized to a portion of the organ in 20, and in 37 no note was made as to whether it was general or local. The contents were described as being mucoid in 4 cases, gelatinous in 12, colloid in 4, fluid in 7, and in 4 cases there were carcinomatous areas present in the walls of the cysts. Of the 32 cases in which the age is recorded it is given as follows: between 1 and 10 years, one case; between 11 and 20 years, two cases; between 21 and 30 years, seven cases; between 31 and 40 years, eight cases; between 41 and 50 years, seven cases; between 51 and 60 years, seven cases. While the great majority recorded were not very large, some were notably so, such as the following cases: Wood's and Combemale's were 20 cm. in length; Finkelstein's measured 15 cm. by 14 cm.; Montgomery's measured 5½ by 4¾ in.; the author's measured 30 cm. along its great longitudinal curvature and 14 cm. in its greatest circumference; Deaver's was the size of an orange; and the one recorded by Virchow was the size of the fist."

The above gives a splendid statistical summary of the condition.

Crouse [4] in 1910 has reported, along with tumors of the appendix, literary citations to fifty-four cases. He reports a total of 256 cases, but fails to give the sources from which all were obtained. He reports no new cases. Crouse also states that of the 256 cases 100 were noted as contents of hernial sacs, 4 were discovered during operations on other organs, and 152 at autopsy.

McConnell [5] in 1907 has added a very interesting chapter to this unusual disease. He reported a case of pseudomyxoma peritonei, occurring in a man, from a ruptured cystic appendix. He also found that Rokitanski,[6] Draper,[7] Vimont,[8] Baillet,[9] and Stengel [2] had reported similar cases. This condition is in every way similar to pseudomyxoma peritonei from a ruptured gelatinous adenocystoma of the ovary.

Wilfred Trotter [10] in 1910 reported a case of peritoneal pseudomyxoma originating from a ruptured cystic vermiform appendix in a man aged thirty-six.

Thomas Wilson [11] in 1912 found a cyst of the appendix during an operation for fibroids in a woman aged fifty-two. He also reports a case in a woman aged sixty-eight, in which the cystic appendix was ruptured during examination, and operation for uterovaginal prolapse a short time later resulted in cure.

Eden [12] in 1912 reported a case of pseudomyxoma of the peritoneum, arising from perforation of a gelatinous ovarian cyst and associated with similar cystic disease of the vermiform appendix. His patient was a woman aged forty-six.

Fritz Colley [13] in 1912 has discussed this type of appendix disease at length, and noted that Virchow found at autopsy an appendix dilated to the size of a man's head. He has also quoted Plem, in which case the cystic appendix the size of a walnut was imbedded in the wall of the cæcum.

Hammesfahr [14] in 1913 reported two cases. The first case occurred in a 38 year old woman, giving a history of chronic appendicitis. At operation the appendix was found to be 5.5 by 13 cm. in size and filled with gelatinous pseudomucin. The second case was operated upon for chronic appendicitis, and the appendix was found to be a pseudomyxomatous cyst measuring 3 by 12 cm. He also reported a case operated upon in 1910, in which the appendix had ruptured and produced a pseudomyxoma peritonei.

MATAS [15] in 1914 reported before the Southern Surgical Association his observation of a case of large myxoid cyst, multilocular, retroperitoneal and retrocæcal, weighing 1582 grammes, in a man aged twenty-five. The appendix was attached to the mass but was distinctly not involved in the cyst formation, and Matas concluded that it probably came from some abnormal embryologic remains in the mesentery.

PHEMISTER [16] in 1914 reported before the Chicago Surgical Society retention cyst of the appendix, presenting three specimens. The first case was diagnosed ovarian cyst in a thirty-six year old woman. At operation a large, sausage-shaped cyst of the appendix was found, measuring 17 cm. in length and 21 cm. in greater circumference. The second was obtained in 1907 from a forty-six-year-old woman suffering from left inguinal hernia. Operation revealed a large, ruptured, cystic appendix with gelatinous pseudomyxoma peritonei. Surgical removal and drainage cured the patient. The third case was a pseudomucinous diverticulum of the appendix, the size of a grape fruit, in a woman forty-six years old. This case has been previously reported by Herb. At the same meeting Percy presented a specimen of a large cystic appendix removed from a patient fifty-five years old, who had gall-stones. The appendix measured 6 cm. by 14 cm. and contained a gelatinous fluid. He also reported finding another case almost as large, but unfortunately the specimen was lost.

HARTMAN and KINDLEY [17] in 1914 have reported a case in a negress aged forty-eight. This appendix measured 11 cm. in length by 5 cm. in its greatest diameter, and was filled with pseudomucin. The authors also cite Corning's [18] report of 4 cases from 735 appendixes removed at operation and sent to his laboratory.

FOWLER [19] in his volume on appendicitis records a case in which there was a nodule the size of hen's egg behind the internal abdominal ring. Operation revealed an S-shaped appendix with a cystic dilatation of the proximal end the size of a walnut.

H. A. KELLY [20] in his work on appendicitis cites the case of Sonnenburg, in which there was a pear-shaped cyst of the appendix 14 cm. long and 21 cm. in circumference. The walls were atrophic and the epithelium was reduced to a low columnar type. There was also present abundant round-cell infiltration in the walls. His illustrations are splendid and he also pictures two cases from his collections.

Symptoms.—As a study of the literature reveals, this condition rarely produces symptoms. Most of the cases were revealed post mortem or were discovered during operations for other conditions. However, a few reports indicate that the patients suffered from symptoms of chronic appendicitis. The most frequent diagnosis, when made, was ovarian cyst of fibroids.

Etiology.—The essential factor concerned in the production of cystic appendix disease is obstruction of the lumen. The obstruction may occur at any portion and produce a cyst distal to the occlusion. Thus, the proximal portion of the appendix may be of normal dimensions, while the distal end may be enlarged to varying degrees. Records

in the literature do not show to what extent the appendix is usually involved. A number of theories have been presented to explain the mode of occlusion: (1) The valve of Gerlach may completely close off the appendix from the cæcum, and the secreting mucosa, being active cyst formation, results. (2) Focalized ulcerative appendicitis may produce destruction of the mucosa with formation of cicatrix, which in turn may contract to produce complete occlusion. (3) External mechanical conditions, among which may be mentioned (*a*) a short mesentery to the appendix with resulting kinking; (*b*) an immobilized, retroperitoneal placement, in which position gaseous or fecal distentions of cæcum may completely close off lumen of appendix (Heinick noted this position 12 times in 3550 autopsies); (*c*) appendicitis with resulting immobilizing parietal or visceral adhesions; (*d*) adventitious membranes or bands about cæcum.

Of these theories the most logical in the author's opinion are those of focalized ulcerative appendicitis with cicatricial obstruction, or malposition of the appendix. Most of the cases reported in the literature do not record the fact that these cases show evidence of acute or subacute inflammation, but that the process is a very chronic one and peritoneal surfaces are smooth.

Pathology.—Microscopic findings are of much interest. The cyst wall in places may be very thin and the muscle fibres may be entirely or in part replaced by connective tissue. The mucosa is usually very much thinned and in places may have undergone complete atrophy. The columnar epithelium in flattened to a cubical shape or may be absent. The glands also in most cases have undergone marked atrophy. There is present a profuse round-cell infiltration throughout the walls. There are noted calcareous deposits in the different atrophic layers. The contents of the cysts is described as gelatinous, mucoid, etc., and is of grayish translucent color. Microscopically, there may be found in the cyst content an occasional stellate or round cell, but for the most part is a nondescript granular material. Chemically, there may be demonstrated calcareous fragments through the contents, which probably accounts for the turbid grayish appearance imparted to it. Careful chemical analysis of the cyst contents proves it to be pseudomucin.

Diagnosis.—The diagnosis of this condition is difficult. A tumor presents in the right lower quadrant of the abdomen, which is elastic and movable to varying degrees unless it is of the retroperitoneal type, in which case it is fixed. This must be differentiated from a tense, distended cæcum, a dystopic kidney, a hydrosalpinx and retroperitoneal cyst. A definite diagnosis, as a review of the literature reveals, has

rarely been made, and has usually been mistaken for ovarian cyst, fibroids, etc. Many of the cases were discovered at autopsy or during operations upon other organs.

CASE REPORT.—The following is the case report upon which this contribution is based: P. H., male, aged thirty-three, farmer, Liberty, Mo., referred by Dr. R. E. Sevier.

Family History.—Negative.

Personal History.—Pneumonia at two years with good recovery. Had the usual children's diseases with good recoveries. Typhoid fever 5 years ago, at which time he was sick in bed for six weeks but made good recovery. This is the only illness in adult life up to the present trouble. His digestion was good until about one year ago, since which time he has been troubled with indigestion. No constipation. Weight was constant until about six months ago, since when he has lost ten or fifteen pounds. Has never been jaundiced, and has had no abdominal pain to present trouble. Negative urinary history.

Present Trouble.—This began insidiously ten or twelve months ago by pain in right lower quadrant of abdomen. Probably no fever, no chills, no vomiting. Appetite became poor and he would eat about one-half his former meal. Eleven weeks ago he had a spell of pain in right lower quadrant of abdomen, which lasted for two weeks. Nine weeks ago he had a sudden attack of painful and frequent urination, which lasted for a few hours and then pain settled again in right lower quadrant. Urine contained no blood. He had some fever but no vomiting, and remained in bed three hours. He did his usual farm work under protest until ten days ago severe pain began again in right lower quadrant which prompted him to call Dr. Sevier, who had to give him a hypodermic for relief. At this time was in bed one day. Two days ago he had another spell, which required a hypodermic to relieve it. Urinary examination is entirely negative, with the exception of a fair amount of indol. He came to the hospital on June 2, 1913.

Physical Examination.—Reveals a well nourished adult man with a palpable, elastic mass in right iliac fossa, slight tenderness. Otherwise the patient was in good physical condition.

Operation.—Operation was performed on June 3, 1913, at which time laparotomy was done through a right rectus incision. At the base of the cæcum no appendix was found, but instead a retroperitoneal elastic tumor was found lying in the right iliac fossa (Fig. 1). The peritoneum was split, revealing a whitish, opaque, comma-shaped, elastic tumor with attachment to cæcum

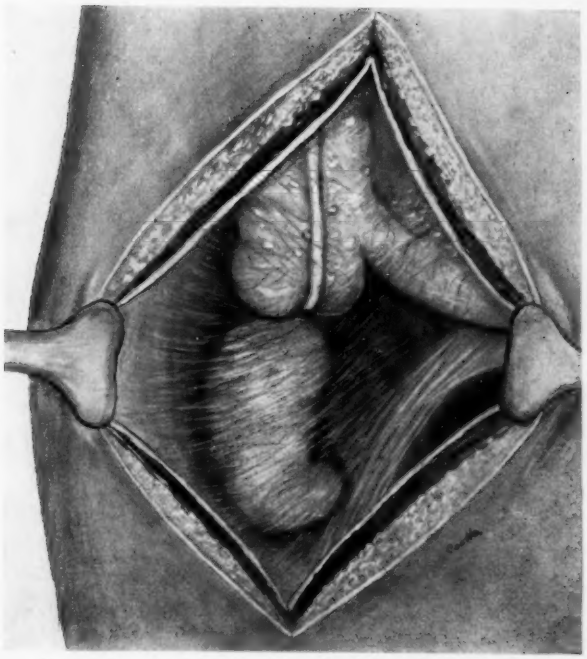

FIG. 1.—Showing cystic appendix, retroperitoneal and lying in right iliac fossa.

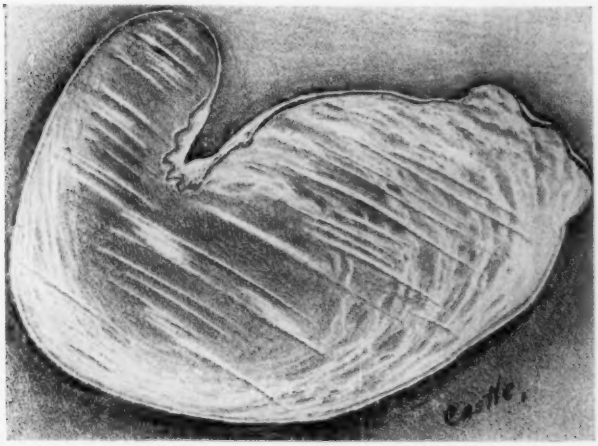

FIG. 2.—Showing cystic appendix cut open longitudinally. Note that contents consist of semi-translucent pseudomucin with clouded strata.

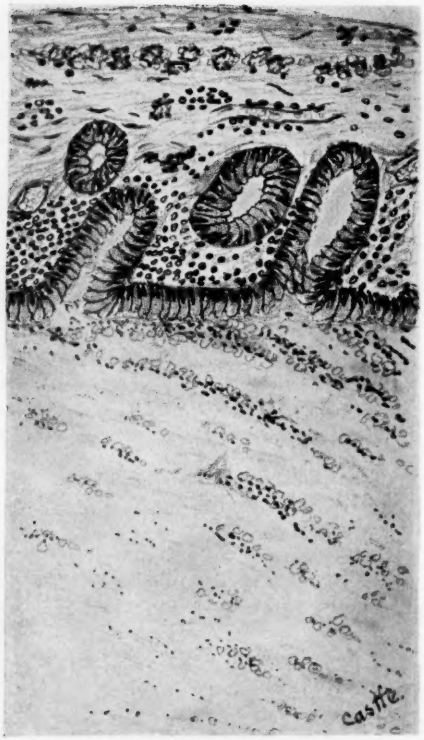

FIG. 3.—Drawing showing histopathology of wall. Note the round-cell infiltration, atrophic muscularis without peritoneal coating, and atrophic mucosa and submucosa. Also note calcareous deposits in wall and aplastic contents of cyst, which is pseudomucin.

at normal appendix site. It was enucleated readily and was carefully dissected from attachment to cæcum without rupture or penetration of gut wall. A few sutures plicated the site of the cæcal attachment and the peritoneum was repaired. The incision was closed in the usual manner, and the patient made a rapid and uninterrupted recovery.

Gross Pathology.—The specimen consists of a distorted cystic appendix, comma-shaped and measuring 5 cm. in diameter and 7.5 cm. in length with circumference at middle 16 cm.; weight, 152 grammes. Upon longitudinal incision the content of the cyst is found to consist of grayish, semi-translucent, gelatinous material (Fig. 2). The substance bulges over the edges of the cut wall. There are whitish, cloudy strata in the substance of the cyst content arranged radially from the lesser curvature of the wall, at which point the wall is thickened to about 2 or 3 mm. The remainder of the wall is almost paper-thin and measures from ¼ to 1 mm. in thickness. There is evidence at the upper pole at cæcal attachment of a moderate herniating of the wall, where it is found the circular fibres are absent and only the longitudinal remaining.

Histopathology.—The wall of the appendix has undergone marked atrophy. The mucosa is absent and the submucosa and muscularis have been replaced by fibrous tissue. At one portion on lesser curvature the wall remains to the thickness of 3 mm., and here is noted a small area where the mucosa, glands and submucosa are still present (Fig. 3). The epithelium is flattened to a cubical shape, the glands are few, and there is present a pronounced diffuse round-cell infiltration. When this was cut through with a knife there was a grating sensation, and microscopic investigation revealed a plentiful distribution of lime salt deposits. Section of the gelatinous substance shows a finely granular aplastic matrix with fine granules of calcareous salts. This was more marked near the remnant of secreting mucosa and was also found to be more abundant in the clouded, opaque strata in the jelly-like contents. Chemical examination of the cyst contents gives characteristic reactions for pseudomucin. It is impossible to state the exact etiologic factor in this case; but it is probable that typhoid ulceration of the appendix occurred during his attack five years ago and complete occlusion resulted from the cicatricial contraction at site of ulceration.

CONCLUSIONS

1. A rare form of appendix disease, available post-mortem records showing it to be present in about .2 per cent. of cases.

2. Total number of cases reported in the literature is from about 85 to 256 (Crouse).

3. Usually symptomless and benign but may, upon rupture, produce pseudomyxoma peritonei in every way similar to that of ovarian cyst origin.

4. A retention cyst of the appendix of variable size and in which various portions of the appendix may be involved.

I wish to express my thanks to Dr. Jabez N. Jackson for the surgical aspects of the case herewith reported.

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PYLEPHLEBITIS COMPLICATING APPENDICITIS

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visiting surgeon, city hospital; surgeon, deaconess hospital

Acute appendicitis is such a frequent disease and the complications are so grave that practically every person has been taught the necessity of operation. There seems to be some question in the mind of some of the laity as to when the operation should be performed. In view of the distressing complications which not infrequently follow an infection of the appendix, and since immediate operation will prevent this disaster and avoid recurrence and will save every patient, providing infection has not extended beyond the appendix, it is evident that the laity should be taught to request immediate removal of the appendix as soon as the diagnosis has been made.

Prior to the classic work of Fitz, Munro, Murphy, Fowler and other American surgeons, it was customary to regard perforative peritonitis as the most frequent and grave complication of appendicitis. Incision, postural drainage, proctoclysis and gastric lavage have succeeded in reducing the mortality to practically *nil*. Murphy deserves special credit for these brilliant results. During the past four months I have operated ten cases in point with two deaths; both fatal cases were practically moribund at time of operation and were regarded as hopeless. I have found adrenalin chloride, in half-drachm doses given intravenously with four ounces of distilled water, to be of very great service in these desperate cases. The injection should be repeated in six hours.

With the almost practical elimination of perforative peritonitis I believe that the most grave present-day complication of appendicitis is pylephlebitis with multiple abscesses of the lung or of the liver. Although Waller's historic first case of appendicitis complicated with multiple abscesses of the liver was reported in 1847, a careful study of the literature shows that we have not accorded due consideration to this important subject. Pylephlebitis occurs with greater frequency than we have appreciated. Many of the cases recover without our having recognized the presence of the complication; many patients die without our having correctly interpreted the clinical picture. Murphy maintains that multiple abscesses of the liver are a rare complication of appendicitis. Ochsner, Deaver and several other prominent American surgeons have not seen more than one case. In 1903 Gerster reported 1189 operative cases of appendicitis, in 9 of which pylephlebitis was present.

Gerster's classic paper deserves careful study. In 1905 Munro reported 15 cases of undoubted portal infection, although Krogius observed this complication in only 2 of his 1000 cases of appendicitis. Bell cites 1726 cases, in only 8 of which was the complication present. Korte recently attracted considerable attention to this subject, and his pioneer surgical work in this field deserves special mention. Korte cites 16 cases in point. Franke's recent monograph is very interesting.

The pathology is quite clear. It is important to remember that the abscesses are practically always multiple. Kelly thought that the complication was always a late one, although his contention is not borne out by experience. The abscesses vary in size; the right lobe is more frequently involved than the left. This is explained by anatomic conditions. Barker refers to several cases in which the infection spread along the lymphatics of the appendix and produced very grave conditions in the glandular and areolar tissue behind the abdominal peritoneum without any local or general peritonitis. In 1893 Shoemaker emphasized the fact that abscesses of the liver following appendicitis are usually small and multiple, and that they are not always due to continuous spread of inflammation to the portal veins, but that they might be due to embolism. In my case of liver abscesses the infection was of the portal variety. Munro was inclined to believe that the appendices that originally are extra-abdominal and without any peritoneal covering are presumably less able to direct the lymph currents within the normal channels, and so give rise to the most fulminating types of lymphatic poisoning. Portal infection is the most frequent source of intrahepatic abscesses. Porier and Cuneo found that the normal termination of the lymphatics from the appendix and cæcum is the glands of the ileocæcal group. Infection may travel from the subphrenic space to the liver, forming secondary abscesses in the liver. In Thompson's interesting case of portal infection, the liver was free from abscesses, although the branches of the portal vein in the liver substance were filled with pus. In 1875 Legg exhibited a case of infection where there seemed to be evidences of healing in some of the hepatic abscesses. Reichardt has expressed the belief that these abscesses may heal by encapsulation.

The most frequent clinical manifestation of multiple abscesses of the liver complicating appendicitis is repeated chilly sensations or distinct chills followed by very high temperature and profuse sweating, and associated with the presence of urobilin in the urine and persistent icterus. Franke was impressed with the fact that urobilin disappeared from the urine as soon as the last abscess had been opened. He em-

phasized the finding that severe pain was the one symptom which pointed to the location of the abscess. Gerster mentions the fact "that chills accompanied by a rapid rise of temperature, observed during the course of an appendicitis, however mild as to the local symptoms, may and usually do signify the entrance of septic material into the portal and general circulation. They must be looked upon as a sign of the greatest import. Should the seizure pass into a continuous fever with dry tongue and retching, a clouded sensoria, with a rapidly rising pulse of deteriorating volume and quality, the body temperature remaining above 103° F., with a tendency of mounting as high as 106° or higher, the diagnosis of acute septicæmia will be justified."

One of the earliest and most impressive diagnostic signs of portal infection is repeated chilly sensations or distinct chills; chill is followed by high pulse-rate, marked elevation of body temperature and profuse sweating. When the above symptoms follow in the wake of the early clinical manifestations of an acute appendicitis and are associated with persistent pain in the region of the liver, jaundice, general depression, septic tongue, the finding of urobilin in the urine, and marked tenderness in the hepatic area without signs of peritoneal or pleural involvement we may feel quite confident that the patient is suffering from septicæmia due to multiple abscesses of the liver. Pain is a very constant symptom and precedes the jaundice. Local œdema may be present.

In my case of multiple abscesses of the lung, the repeated chills associated with a septic temperature and persistent cough were prominent symptoms. The site of the severe pain was a valuable indication of the location of the abscess. Change in the respiratory murmur appeared at site of pain several days before percussion revealed any change.

In a typical case of multiple abscesses of the liver complicating appendicitis the diagnosis should not be difficult. In any given case the diagnosis must rest on (1) the history showing that the appendix was the primary seat of trouble, (2) the shifting of the symptoms from the appendix to the hepatic region, (3) the progressive increase in the severity and character of the symptoms, (4) the repeated chills followed by high pulse-rate and marked elevation of body temperature, (5) the jaundice, (6) the persistent pain in the hepatic region, (7) the urinary and blood findings, (8) the change of liver dulness, (9) the picture of marked toxæmia, and (10) the absence of the signs and manifestation of extensive peritonitis. Munro is, I think, correct in maintaining that *the most important clue in making a diagnosis is the recognition of the causative appendicitis.* The fact that an appendicitis patient is suffer-

ing from repeated chills followed by high temperature and profuse sweating indicates clearly the gravity of the situation and points to a septic condition somewhere; when the physical findings point to the liver, it is time to consider immediate exploration. I am not a supporter of the aspiration needle prior to exposure of the liver, unless preparations have been completed for immediate intervention in case aspiration locates the pus.

The prognosis of the complication in point is necessarily grave. Prior to the pioneer work of Korte and Franke the complication was regarded as practically always fatal. Lemarie's experiments indicate that the liver offers to the colon bacilli protection against a general infection up to a certain extent. Munro held that this fact bears out the belief that spontaneous healing in liver abscesses is not impossible nor even infrequent in cases of mild infection, and that this is shown by the recovery at times of patients who present the typical signs and symptoms of hepatic abscesses in the course of an appendicitis. In 1875 Legg exhibited a case of infection where there seemed evidence of healing in some of the hepatic abscesses. Thompson's finding that portal infection may occur without the formation of liver abscesses even though the branches of the portal vein be filled with pus would tend to explain Munro's recovered cases of supposed hepatic abscesses. The prognosis in any given case in point depends on (1) the size, multiplicity, and location of the abscesses, as well as their accessibility from a surgical stand-point, (2) the time of their discovery, and (3) the general condition of the patient together with the character and time of the treatment.

The treatment of pylephlebitis with multiple abscesses of the lung or of the liver is quite clear. The appendix should be removed, the infected lymphatics leading from the appendix to the liver should be incised and drained, and the liver should be exposed and the abscesses located and also drained. The abscess or abscesses in the lung must be located and drained. The intense pain will frequently guide the surgeon to the site of the abscesses. I do not feel that it is advisable to aspirate the liver until the latter has been duly exposed, unless preparations for immediate intervention have been completed. I am a strong supporter of the lumbar drain in these cases.

REPORT OF CASES

CASE I.—C. E., age forty, white male, was seen in consultation with Drs. Hamm, Keiser and L. H. Hempleman to whom I am indebted for the following history: Illness began February 2,

1913; patient complained of usual symptoms of appendicitis; he gave history of previous attacks; was admitted to the Deaconess Hospital February 7, 1913, at which time his pulse-rate was 100 and temperature 101°. Operation was performed by Drs. Keiser and Hamm on the following day, and an adherent appendix was removed; pus was not noted; appendix was ruptured during removal; tube drainage. Patient did not make the usual prompt recovery. On the day following operation his temperature registered 101°, and pulse 98. On the fifth day post-operative he complained of severe pain in the region of right lobe of liver. Drainage very scant and tube was removed. Six days after operation and on the day following the severe pain in hepatic region patient suffered a *severe chill;* two hours later he had a second chill, and four hours thereafter a third chill. The first chill was followed by a temperature of 104°; the second chill was followed by a temperature of 101°; in neither instance was the fever followed by profuse sweating. Two days after first chill the patient had his fourth chill; this latter was followed by a temperature of 104° and a pulse-rate of 120; no sweating. Quinine was administered and no chill was noted for seven days, although patient continued to complain of more or less constant and severe pain in the region of the gall-bladder. On February 24 the fifth chill occurred; temperature registered 101°, patient complained of very severe pain in region of gall-bladder; nausea and vomiting were prominent symptoms. One week thereafter the seventh chill was recorded; pulse 120, and temperature 103°; patient perspired freely thereafter and vomited large quantity of bile. Dr. Hemplemann was called in consultation, and recommended that a surgical consultation be held.

The writer saw the patient at this time, just a month after the onset of symptoms. Patient was complaining of excruciating pain in region of gall-bladder; expression anxious and drawn; markedly jaundiced; temperature 102°; pulse 112; abdomen not distended; operation wound was still open, but discharging only a slight amount of a seromucoid substance; area of liver dulness increased; exquisite tenderness in gall-bladder region; thoracic findings normal; no evidence of subdiaphragmatic abscess or abscess in renal pouch. The possibility of hepatic abscess and of empyema of gall-bladder were considered. The patient appeared to be in a very desperate condition; he was septic and an immediate exploratory operation was recommended by Dr. Hempelmann and the writer.

A very tense and greatly enlarged gall-bladder was found; the liver was not adherent to the diaphragm, and abscess was not demonstrable; the lymphatics extending from the meso-appendix

to the liver were very much enlarged and very firm. The renal pouch was free from pus; there was no evidence of a subdiaphragmatic abscess. It was concluded that the liver abscesses were of the minute and multiple kind and a very unfavorable prognosis was given. Five days thereafter the patient began to cough, and examination of right chest showed slight effusion and marked increase in area of liver dulness. The chest cavity was aspirated and a clear fluid obtained. A second aspiration was made and the diaphragm was perforated and the needle introduced into liver substance; pus and bile were found. Immediate operation was performed and four separate and distinct abscesses of about the size of a small guinea egg were located in the right lobe of the liver. These were drained. The patient did well for six days, then became delirious and gradually sank. The body was shipped before examination could be made.

CASE II.—G. S., white male, aged forty-two, was seen in consultation with Dr. Bewig on the third day of an acute attack of appendicitis. History of previous attacks. The clinical findings indicated a perforative peritonitis. Immediate operation showed appendix perforated and abdomen filled with pus. Postural treatment and proctoclysis were followed by satisfactory results until the fifth day, when patient complained of a dry, persistent cough and chilly sensations; pulse and temperature showed marked excursions, sweating was profuse. Patient lost flesh rapidly and could not sleep on account of the persistent cough. Delirium was noted. The abdominal symptoms disappeared rapidly and drainage was practically *nil* after the tenth day. On the twenty-first day post-operative the patient complained of severe pain in the region of the right nipple, although the physical findings were negative. Three days later aspiration revealed pus. Operation showed abscess of lung. The cough and sweating persisted. Liver was exposed under local anæsthesia and aspiration failed to locate pus. The following day patient complained of severe pain in region of angle of right scapula, two days later auscultation and percussion showed evidence of abscess; aspiration revealed a pocket of pus. The abscess was in the lung tissue. During the succeeding five days the patient seemed to improve. He then complained of dyspnœa, and severe pain in upper part of right lung, but repeated aspiration was not successful in locating the abscess. The patient became markedly exhausted. No pain in region of liver or in abdomen was complained of. The temperature fluctuated between 99° and 101°. Pulse was always very rapid and flickering. Dyspnœa increased and relatives refused further aspiration. Ten days after onset of final symptoms, the patient was suddenly seized with a severe spell of coughing, during

which attack the abscess ruptured into a bronchus and death followed. Autopsy refused.

CASE III.—This patient was under the care of Dr. James Stewart and was seen by me through the courtesy of Dr. Stewart and Dr. Roland Hill. The patient was seen by Dr. Hill ten days after onset of symptoms of acute appendicitis. The patient had refused early operation. On the tenth day the patient complained of severe pain in region of left nipple; the pulse rose from 100 to 130, and the temperature which had been between 99° and 100° rose to 103° F.; respiration 36. Five days later the liver became markedly tender and enlarged; jaundice present. Several days later, Dr. Hill resected portions of the seventh and eighth ribs and evacuated six ounces of pus from chest. Five days thereafter the first chill appeared; a few hours later the second chill occurred, and the temperature rose to 105°, pulse 140, and was followed by profuse sweating and gradual decline of temperature to subnormal. Emaciation, progressive weakness, irregular chills and temperature reading, profuse sweating, jaundice, and pain in region of liver were prominent symptoms, and the picture in general pointed to abscesses in the liver. Second operation was performed and liver was aspirated repeatedly but without success. Autopsy showed liver studded with very small abscesses; one abscess was about the size of a hen's egg; the veins of right lobe of liver were filled with pus; in the blood of the heart were found short chains of streptococci; the appendiceal submucosa showed small areas of necrosis, and the cavity at the distal portion of appendix was dilated and filled with disintegrated material.

Remarks.—These three cases demonstrate the distressing and grave character of the complication in point. They exemplify the fact that the secret of success in the treatment of appendicitis to-day is immediate removal, removal before the infection has passed beyond the walls of the organ in question. *Active purgation has no place in the treatment of acute appendicitis.* Enemata and ice combined with proctoclysis and Fowler's posture yield the best results whenever operation has been refused.

My first case demonstrates the fact that the classic symptoms are not always present; the chills do not always recur at regular intervals, and sweating may be a late symptom. Pain, jaundice, irregular temperature reading, exhaustion, and increased liver dulness directed us to the liver and gall-bladder. It is possible that if we had incised and drained the lymphatics and infected vessels it might have prevented the formation of abscesses in the liver and relieved the patient. Of

course this is only a conjecture, since the infection may have advanced to the liver before operation was performed.

Case two is a typical case of multiple abscesses of the lung complicating appendicitis. I did not find more than a single similar case in the literature. It exemplifies the danger of these abscesses rupturing into a bronchus. It is to be regretted that an autopsy could not have been obtained.

Case three is a quite typical case. The repeated chills, wide excursions of pulse and temperature reading, the site and character of the pain, the jaundice and the emaciation were quite characteristic. The abscesses were so small and so numerous that a successful issue was impossible.

Surgery is destined to bring relief to many of these grave cases in which the abscesses are superficially located and the medical attendant is sufficiently familiar with the clinical picture to detect the probable location of the pus. So much depends on the severity of the infection, the number, size and location of the abscesses. Korte has demonstrated the possibility of successful intervention in some of the seemingly hopeless cases so that the surgeon is justified in giving the unfortunate sufferer the possible benefits of an exploratory operation. Local anæsthesia may be used in many of these cases.

A NEW METHOD OF LATERAL ANASTOMOSIS OF BLOOD-VESSELS AND AN OPERATION FOR THE CURE OF ARTERIOVENOUS ANEURISM*

By J. Shelton Horsley, M.D.

of Richmond, Virginia

Lateral anastomosis of blood-vessels is used either in uniting a vein to a vein, as in the Eck fistula when the portal vein is joined to the vena cava, or in uniting an artery to a vein when it is necessary to reverse the circulation. The indications for Eck fistula are few, if any, so far as its clinical application is concerned. The operation was described by Eck, a Russian surgeon, in 1877 and again in 1879. It has been performed a few times by German surgeons in cirrhosis of the liver (Rosenstein, German Surgical Congress, 1912), but the metabolic products from the portal circulation sooner or later produce a toxic effect when discharged into the general circulation at a rate as great as the Eck fistula permits. Again, it is possible that the ascites may be due to irritation of the peritoneum and not solely to portal obstruction.

The indications for reversal of the circulation are still under much dispute. Halstead and Vaughan (*Surgery, Gynecology and Obstetrics,* January, 1912) reviewed the literature and reported personal experiences. They conclude that the operation for reversal of the circulation has no practical value. Coenen, of Breslau, opposes the operation and gives his reasons at some length. They are that the valves must be forced, that it is probable the arterial blood following the route of least resistance goes through the first anastomotic vein back to the heart and rarely if ever reaches the terminal branches of the vein, that in arteriovenous aneurism it takes weeks and sometimes months for valves to be forced sufficiently to detect pulsation in the smaller veins, and that the arterial blood in venous capillaries must have some manner of return which has not yet been fully studied. There are many pathological conditions in man, such as arteriosclerosis, thrombo-angeitis obliterans, diabetes, Raynaud's disease, that do not occur in experimental work. When the vessel itself is diseased at the site of the anastomosis,

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or when the veins are involved in the disease, reversal of the circulation is useless. When gangrene has already occurred, of course operation for reversing the circulation cannot bring relief.

The practical utility of reversal of the circulation is doubtful. Some experiments which I have recently performed and which are not yet ready for full report seem to show that in reversal of the circulation the blood returns to the heart by anastomotic venous branches a short distance below the site of the operation, and that the arterial blood in a reversed femoral vein does not reach the foot and usually goes but little below the knee.

If the circulation is to be reversed, it should be done by lateral anastomosis and not by an end-to-end union. When the vein and artery are both cut across and the artery united to the vein end-to-end, the remaining channel of the artery is sacrificed, whereas if lateral anastomosis is performed and the vein ligated on the cardiac side, there will be two channels for the arterial blood instead of one. The original arterial channel is not put out of commission and at least no harm will be done even if no good is accomplished. This was originally pointed out by J. B. Murphy and has later been demonstrated and insisted upon by Bernheim and others.

When the main artery to a limb is partially occluded and the veins are healthy, the arterial blood in the capillaries is probably drained off more quickly than normal. Thus the tissues are not bathed with arterial blood sufficiently long to be nourished properly. Obstructing a large vein may prevent this rapid passage of arterial blood and so equalize the circulation and improve the condition of the limb. In this way may be explained some of the reported improvements that have followed reversal of the circulation in a limb, particularly after the end-to-end method.

When doing a lateral anastomosis of artery and vein, Bernheim and Stone (ANNALS OF SURGERY, October, 1911) recommend making the opening in the vessels by transfixing them with a cataract knife and cutting from within out about one-third of the circumference. The vessels are then cleaned with either normal salt or Ringer's solution, anointed with liquid vaseline, and united by a continuous suture of fine silk.

Bernheim and Boegtlin (*Bulletin of Johns Hopkins Hospital*, February, 1912, page 33) discuss the question of whether an Eck fistula is compatible with life and describe a new method of making this fistula. The portal vein and vena cava are first sewed together with a small curved needle and silk, using a continuous suture and No. 3 curved

French intestinal needle with double thread. Another row of sutures is made parallel with this, and an especially constructed scissors with sharp points is partly opened, one blade plunged into the vena cava, and the other into the portal vein. The partition between the two rows of sutures is then cut. A previously inserted suture is quickly tied at the point of the puncture of the scissors. They claim that Eck fistula in dogs is consistent with life for a long period of time provided the diet is regulated, though certain hepatic functions are decreased when an Eck fistula is present; notably, tolerance for sugars, the formation of bile, and the hæmolytic function of the liver.

The technic of Bernheim is similar to that of Sweet, who, in 1904, described a method in which a fine platinum wire was passed into the veins and an electric current connected, after the two rows of sutures had been placed, so burning an opening.

The technic of Carrel and Guthrie involves dissecting the vena cava and the portal vein and clamping them above and below the site of operation, which is difficult and tedious. The union is made with straight arterial needles.

If a lateral anastomosis is to be done on easily accessible vessels, the operation is simple, but if the vessels are difficult to expose, or if hæmostasis cannot be complete, it becomes very trying. In an effort to standardize a technic that could be used in all cases of lateral anastomosis, whether in making an Eck fistula, or in uniting an artery and vein in a difficult location, I have devised a forceps that takes a lateral hold either on the entire caliber of each vessel, or on any portion of it as desired. The necessity for such a forceps was suggested by an operation done by me at the clinic of Professor W. L. Rodman, in Philadelphia, through the courtesy of Professor Rodman. The case was an arteriovenous aneurism of the femoral artery and vein, too close to Poupart's ligament for the application of a tourniquet. After dissecting the artery and vein above and below the aneurism, placing Crile clamps on these vessels above and below the lesion, clamping the profunda and controlling the internal branches, an attempt was made to dissect behind the aneurism. This was difficult and bloody, but it was thought that the blood was what remained in the sac and tissues. An incision into the communication between the vessels was followed by profuse bleeding that was controlled with considerable difficulty. It was suggested by Prof. Rodman and by Dr. Stewart Rodman, who kindly assisted in the operation, that a forceps that could clamp these vessels before dividing them would be advantageous. On looking up the matter afterward, I found three kinds of forceps for clamping

vessels for lateral suture. One was Joani's clamp (*Keen's Surgery*, vol. 5, page 128). I have never seen this instrument but from the illustration the points appear frail and the handles are at such an angle to the blades as to interfere with suturing. The forceps of Stewart (*Journal A. M. A.*, August 20, 1910), the jaws of which consist of large ovals, could not be used in arteriovenous aneurism. The instrument of Jeger (presented at German Surgical Congress, 1912), a diminutive Roosevelt gastro-enterostomy clamp, has straight blades and the middle blade is objectionable. It was devised for making an Eck fistula.

After experimentation and several changes, a model was devised that seems to obviate the objections of the other instruments (Fig. 1). These forceps for lateral suture are five inches long, have thin, well-tempered curved blades with longitudinal grooves, and handles that extend in the axis of an imaginary line drawn from the tip to the heel of the blades. The blades fit accurately but are soft enough to be clamped on the skin of the forearm without pain. They can hardly injure the intima, but to make this even surer, soft, pure rubber tubing is slipped over them. The tubing should not be too close to either the heel or the tip of the blades, as this might interfere with the pressure in the middle of the blades and so cause leakage. Such forceps can be used for suturing lateral wounds of large blood-vessels without entirely obstructing the blood-current. In making an Eck fistula, the axis of the handles makes it possible for the handles to lie flat in the abdomen and so be out of the way. These forceps can be used where no tourniquet can be applied, as on the iliac vessels; or in operations on an arteriovenous aneurism where hæmostasis is not satisfactory by other means. Even where hæmostasis is complete, they serve to steady the walls of the blood-vessel while sutures are inserted and lessen the amount of intima exposed, so preventing it from drying.

These forceps have other uses than for lateral anastomosis, or the cure of arteriovenous aneurism. For instance, they can be employed for hæmostatic forceps instead of the Crile clamp, acting in the same manner as the forceps of Matas, which are designed for temporary occlusion of the vessel. As the blades are very soft, they can be very quickly applied and locked without fear of injury to the intima. I have also used the forceps satisfactorily in a gastro-enterostomy in an infant four weeks old when an operation was necessary on account of pyloric stenosis.

In lateral anastomosis of blood-vessels, whether uniting veins as in Eck fistula, or an artery to a vein, the general principles of blood-vessel suturing should be observed. Asepsis should be rigid, hæmostasis complete, the tissues should be handled gently, the adventitia should be

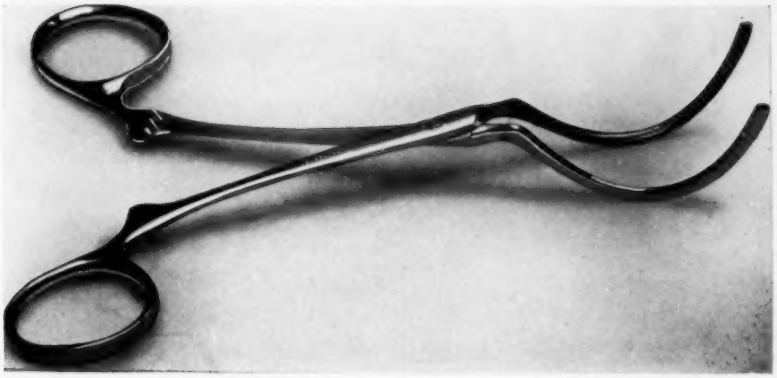

FIG. 1.—Forceps for lateral blood-vessel suturing. They are made with very light blades which can be clamped on the skin of the forearm without pain. The handles lie in the axis of a line drawn from the tip to the heel of the blades. In this way the handles will lie flat even in a deep wound and be out of the operator's way. In order still further to prevent injury to the intima, the blades may be covered with soft rubber tubing.

FIG. 2.—One forceps is shown covered with rubber and grasping the vessel preparatory to making a lateral anastomosis. If it is deemed unwise to occlude all of the vessel, only a portion of it can be caught.

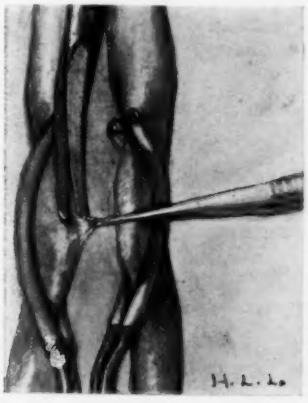

FIG. 3.—The two vessels to be anastomosed have been clamped. The adventitia is being lifted and cut away.

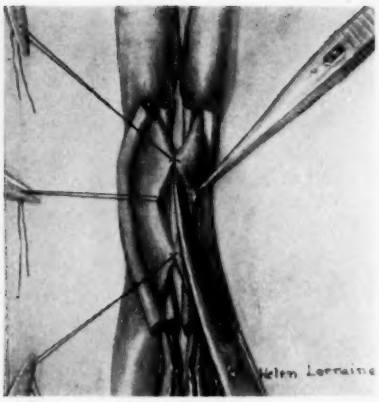

FIG. 4.—The openings in the two vessels are being made. The method illustrated in this drawing is that which should be employed in an Eck fistula. A small point of the vein is caught with the fine thumb forceps, lifted up, and the apex cut away with scissors parallel with the vessel. This is done on each side after the two guy or stay sutures have fastened the veins together near the end of the proposed incision. After a small hole has been cut, a tractor suture is inserted in the left wall of the vena cava and is clamped with forceps but is not tied. Another suture is inserted in the right (operator's right) wall of the portal vein by passing the needle from without inward. The needle is left attached but the suture is not tied. By pulling on these sutures, the small openings are exposed and can be enlarged as a slit with scissors. If a transverse opening is made here, the ends of the transverse incision will retract in the deep wound.

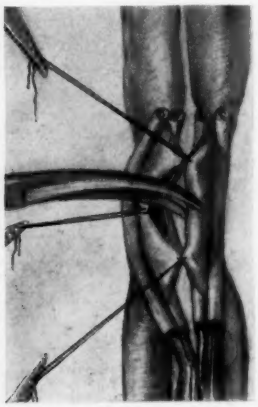

FIG. 5.—This shows a transverse cut, which is the method used in suturing an artery in making a lateral anastomosis for reversing the circulation. The transverse cut in the artery retracts into an oval opening. A similar opening is made in the vein. The tractor sutures are inserted as described in Fig. 4.

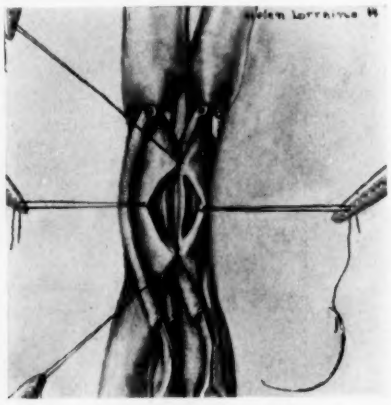

FIG. 6.—The two stay sutures and two tractor sutures are inserted and the openings are ready for suturing.

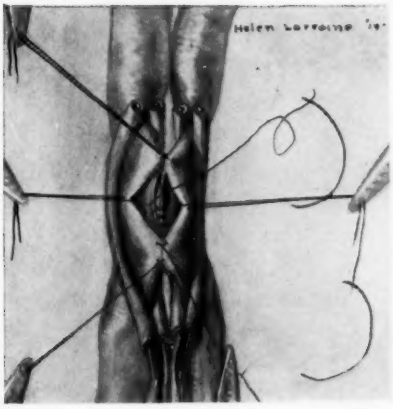

FIG. 7.—Suturing has been begun by using a very fine curved needle and black silk. It is started by going from without inward on one side and from within outward on the other side. The thread is then tied, which leaves the knot *outside* of the lumen. The end of the thread is caught in a clamp. The needle is then thrust through the artery near the knot and suturing begins as an overhand continuous stitch. It is important to have the knot placed in the angle of the incision.

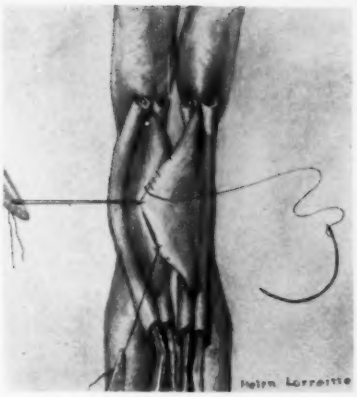

FIG. 8.—The suturing is continued and, after the upper angle is reached, the tractor suture on the left is removed and the needle and tractor suture on the right thrust through the margin of the left vessel. This is tied and when lifted up brings the sides accurately together and renders the suturing easier. After the thread has reached its original starting point, it should be carried about one stitch beyond the knot and tied snugly to the end that was clamped in forceps.

FIG. 9.—The lateral anastomosis is completed. The technic is practically the same for an Eck fistula or an arteriovenous anastomosis, except as shown in Figs. 4 and 5.

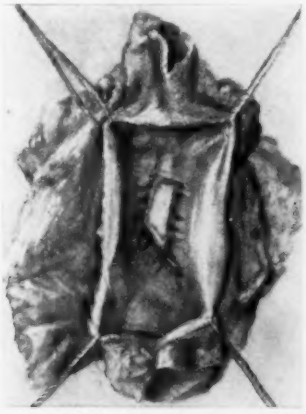

FIG. 10.—Drawing of a specimen of an Eck fistula in a dog 6 days after the operation. There is no thrombosis.

FIG. 11.—Lateral anastomosis between the carotid artery and external jugular vein in a dog. Note the clear opening and just below the opening a valve in the vein. Specimen removed twenty-one days after operation.

FIG. 12.—This shows how the clamps for lateral suture may be applied on an arteriovenous aneurism without the necessity of fully dissecting out the aneurism.

FIG. 13.—The communication between the artery and vein has been divided and the vessels are being sutured. It is best to use a cobbler's stitch and fine arterial needles in the artery, but if this is impossible, a fine curved needle may be used.

removed, and after the intima is exposed the operation should be completed as quickly as possible by uniting intima accurately to intima leaving but little foreign substance or suture material exposed in the lumen.

The vessels are exposed as fully as possible and are mobilized. It is not necessary to dissect both vessels entirely free from their beds, if they are close together. The adventitia over the parts of the vessel to be incised is dissected off and the lateral clamps described applied, catching a deep hold on the vessel wall (Figs. 2 and 3). Both are applied in the same direction. It is better, if possible, for the vessel to be stripped of blood while placing the clamps. After both clamps are fastened, the vessels are anchored together with two stay sutures of fine silk sterilized in vaseline and placed at a little distance from the two extremities of the proposed anastomotic opening. The ends should be left long and the vessels manipulated by these stay sutures and not by the handles of the clamps, which might slip or pull off with too much traction. An incision is then made into the vessels. This is done when an artery and vein are united by incising the artery transversely for about one-third of its diameter with sharp scissors (Fig. 5). The wound retracts leaving an oval opening, and is smeared with white vaseline by dipping a finger of the left hand in vaseline and anointing the wounded vessel. The opening in the vein is made in a similar manner and should be slightly larger than the opening in the artery. A fine thumb forceps, or " frog " forceps, holds the vessel wall while it is being incised and enables the surgeon to make the opening more accurately. A tractor suture of fine silk sterilized in vaseline is placed in the left margin of the opening in the left vessel. This is not tied but clamped with mosquito forceps. A similar tractor suture is placed in the right margin of the right vessel, but the needle end is left attached and the suture is placed from without inward (Fig. 6). The sewing is now begun with a small curved arterial needle (or No. 3 French intestinal needle) and fine silk sterilized in vaseline, starting from the angle of the incision nearest the handle of the forceps. The needle is thrust through the wall of the vessel at the angle, going from without inward on one side and from within out on the other. The thread is then tied, holding the ends of the thread taut while running down the second knot to prevent slipping. This leaves the knot outside the lumen. The short end is clamped with mosquito forceps. The needle is again thrust through the blood-vessel wall near the knot, and a continuous overhand suture is applied, uniting the intima accurately (Fig. 7). This can be easily done, using a mosquito forceps for a

needle holder if necessary, and pulling on the tractor and stay sutures as indicated to expose the margins of the vessel wound. At the other angle care is taken to place the sutures closely, for leakage is likely to occur here. After this angle has been sutured, the left tractor suture is removed and the needle on the right tractor suture is then thrust through the wall where the left tractor suture was, and this suture is then tied (Fig. 8). The excess of vaseline is squeezed out, the tractor suture is lifted up so as to evert the intima, and the sewing is continued as an overhand stitch. When the original knot in the continuous suture is reached, about one stitch is taken beyond it and the thread tied to the end that was left clamped in mosquito forceps (Fig. 9). The clamp from the vein is first slowly removed and the line of suturing slightly compressed with dry gauze. After a minute the arterial clamp is slowly relaxed and then removed if no markedly spurting point occurs. If it does, the clamp is re-applied and a suture placed at the spurting point. A ligature is tied on the cardiac side of the vein to prevent the blood being immediately returned to the heart.

In making an Eck fistula this same technic is followed, except in incising the blood-vessels it was found that a transverse incision was not practical in large, thin vessels in such a deep wound, for it was difficult to suture the deepest portion of the transverse incisions. The opening in the veins is made as follows: A very small bite of the vena cava about the middle of the proposed incision is caught with the "frog" forceps or with mosquito forceps and pulled up to form a cone whose apex grasped in the forceps is cut off with curved scissors (Fig. 4). A tractor suture is inserted in the outer wall of this small opening in a similar manner as in arteriovenous anastomosis. The same procedure is carried out on the portal vein and a tractor suture inserted from without inward and the needle left attached. These openings are then enlarged longitudinally as far as desired. The rest of the technic is followed exactly as described for arteriovenous anastomosis. It is possible, however, to use successfully a coarser needle and thread in Eck fistula than in arteriovenous anastomosis, as the pressure is very low in the large veins.

In operations upon arteriovenous aneurism, if a tourniquet can be applied and complete hæmostasis obtained, the division of the communication and suturing the vessels are often simple, but even in such instances the use of these forceps would probably make the suturing easier.

When it is impossible or impracticable to secure complete hæmostasis by a tourniquet the problem is much more difficult. If the nu-

trition of the limb is seriously affected, or if the heart shows signs of failing under the extra strain on the venous side, operation should be attempted. In a heart that is already incompetent, pressure upon the aorta for temporary hæmostasis, or ligation of a large vessel, might result disastrously, and the safer method under such circumstances would be to reëstablish the circulation in both the artery and vein. Here it is advisable to dissect both vessels carefully, exposing the lesion, and then to grasp the artery and the vein with the forceps for lateral suture of blood-vessels (Fig. 1). After grasping the artery and vein their communication is severed, the edges of the wound in the vessels properly trimmed, and with a cobbler's stitch in straight arterial needles or an overhand stitch in a curved needle, the opening in the artery and then in the vein is closed (Figs. 12 and 13). If possible without too much constriction of the lumen, a continuous reinforcing stitch over this may also be used. As the artery is often dilated on the cardiac side of an arteriovenous aneurism and constricted distally, it would be advisable to diminish the pressure from the enlarged artery by partially closing its lumen with a surrounding strip of fascia, a loosely applied aluminum band, or infolding the artery by sutures as suggested by Matas and Allen.

THE "TONGUE-DEPRESSOR" GASTRO-ENTEROSTOMY CLAMP

By Charles L. Gibson
of New York
SURGEON TO THE NEW YORK HOSPITAL

The accompanying illustrations (Figs. 1, 2, and 3) clearly indicate the make-up of the clamp for gastric and intestinal anastomoses. Three small pieces of wood, the ordinary wooden tongue-depressors, are bound together by any suitable method, such as a strong artery clamp, or, if more convenient, a sterile rubber band. It is needless to point out that the tongue depressors might be replaced by strips of cigar boxes.

This clamp is presented, not as a freak or for its possible cheapness, but because in my hands, both in experimental and clinical work, it has proven much more satisfactory than the Roosevelt, Bartlett and other clamps used for this purpose. I have found it particularly satisfactory in doing a gastro-enterostomy, when it is desired to release the clamp in putting in the last mucous muscular suture and the final peritoneal suture. Removing the rubber band allowed the tongue depressors to fall apart without further manipulation. By this method injury to the viscera is less likely to be produced.

Two gastro-enterostomies and one entero-anastomosis have been successfully done with the aid of these clamps. The first case was that of a man, twenty-nine years, with symptoms of gastric ulcer. Upon operation, which was done November 19, 1914, the stomach was found to be markedly distended, with an indurated ulcer, juxtapyloric, on the lesser curvature, and some stenosis. A gastro-enterostomy with the tongue-depressor clamps was successfully done.

The second case was that of a man, twenty-two years old, with a saddle-shaped ulcer located close to the pylorus. A posterior gastro-enterostomy was done with the tongue-depressor clamps.

The third case was that of a man, twenty-two years old, with tuberculosis of the intestines, particularly involving the mesenteric nodes, with an incomplete obstruction of a coil of jejunum resulting from diffuse adhesions. A successful entero-anastomosis was done with the aid of the tongue-depressor clamps.

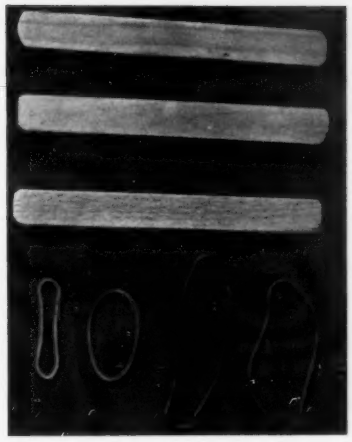

FIG. 1.—Elements used in tongue-depressor clamp.

FIG. 2.—Clamp applied to intestine.

FIG. 3.—Both loops clamped and clamps approximated and held by rubber bands.

THE PREVENTION OF KELOIDS IN SCARS BY THE UNDERLINING OF INCISIONS WITH STRIPS OF FASCIA LATA*

By Leonard Freeman, M.D.
of Denver, Colo.

The free transplantation of fascia lata has been employed recently for a variety of purposes—in operations for hernia; to close defects in the abdominal wall, the pleura, the dura, the bladder, the intestinal tract, the trachea and the larynx; in nephro- and gastropexy; for elevation of the corner of the mouth in facial paralysis and of the eyelid in ptosis; for the reinforcement of suture-lines in operations upon the intestines; for closure of the pylorus in gastro-enterostomy; for the repair of tendons and the formation of new ones; in the mobilization of anchylosed joints, etc.

It is well adapted for all these purposes because of its strength and non-elasticity; its remarkable tendency to heal in, even, at times, in the presence of infection; and because it does not undergo absorption, but remains unchanged within the tissues. The material is abundant and easily obtained. It may be removed from the thigh in narrow strips or in large areas, with or without closure of the resulting gap in the fascia, there being little danger of subsequent injury to the functions of the extremity.

To the uses already reported I desire to add a new one which is perhaps of some importance:

One of the disagreeable things which may follow a surgical operation and detract much from an otherwise satisfactory result is hypertrophy of the cicatrix—a so-called "false keloid." The scar becomes thick, elevated and red, and if in an exposed position it is a source of mortification to both surgeon and patient.

No reliable method has been devised for the removal of these keloids. When excised they almost invariably return, owing to the continuation of the causes which produced them, and the injection of thiosinamin and other substances is equally unsatisfactory.

The hypertrophy seems mainly due to tension upon the scar, and hence it is seen in connection with longitudinal rather than with cross

* This method was described in a discussion before the International Surgical Society, New York, April 14, 1914.

incisions. Wounds about the neck, the abdomen or the joints which run at right angles to the line of normal tension are seldom if ever followed by much hypertrophy, while those parallel to the line of tension are frequently affected, as may be observed in the axilla after operations for cancer of the breast and about the neck following various surgical procedures. Hypertrophy is particularly apt to occur in tuberculous patients, owing, perhaps, to substances circulating in the blood, or present in the skin, which predispose to the excessive formation of fibrous tissue. Hence conspicuous and deforming scars often follow operations for tuberculous glands of the neck.

Some months ago a young and handsome woman consulted me regarding the removal of a disfiguring scar resulting from an operation for tuberculous lymph-nodes of the left side of the neck. It extended from the mastoid to the centre of the clavicle and was as wide and as thick as one's thumb. It was fiery red and formed a conspicuous and mortifying deformity, as it stretched across the neck like a great "flying buttress."

Knowing that excision of the cicatrix would be followed inevitably by a prompt recurrence, as had been my experience on previous occasions, it occurred to me that if tension upon the new scar could be eliminated, it would be placed under the same conditions as a cross-incision, and reappearance of the hypertrophy might be prevented.

Hence, with this idea in view, a strip of fascia lata was procured from the thigh, long enough to reach from the mastoid almost to the clavicle, with the head in the median position, and about as broad as one's finger. After thoroughly extirpating the scar and undermining the edges of the wound, the strip was spread lengthwise beneath the incision. It was then fastened to the under surface of the skin and fascia on one side, and to the deeper tissues on the other side, with a few sutures of fine catgut, thus permitting the union above it of the integument and cervical fascia without danger of displacement. Primary union was obtained.

Posterior to the longer scar described above was a much shorter one, which was also hypertrophied and red. This was likewise excised, but for various reasons was not underlined with fascia lata, although the deep fascia was carefully sutured. Hence this second scar became a sort of "control experiment."

At the end of over 12 months the results of the procedure are as follows: When an attempt is made to incline the head to the opposite side, the movement is checked by the strip of fascia lata, which stands out plainly beneath the skin. This does not inconvenience the patient, because the same check was produced to even a greater extent by the

false keloid. There is absolutely no pull upon the new scar, which is soft and freely movable upon the surface of the underlying graft. There is little tendency to hypertrophy or redness, except near the clavicle, to which the fascial strip unfortunately did not quite extend. In other words, the new scar is relatively inconspicuous and " normal," much to the satisfaction of the patient.

It is interesting to note, however, that the smaller, posterior scar, the " control experiment," which was not underlined, has become markedly red and elevated, in spite of its being relieved from a certain amount of strain by the anterior fascial graft; while the longitudinal scar upon the thigh from which the graft was obtained is fiery red and almost as broad and thick as one's little finger.

It must not be lost sight of, however, that a part of the satisfactory outcome may be due to the mere underlining of the incision with a layer of tissue corresponding to a smooth, firm, intact deep fascia, and not altogether to the relief from longitudinal strain; but however this may be, the value of the method remains the same.

A second case upon which I operated in a similar manner was that of a young woman from whose neck a mass of tuberculous glands had been excised, leaving a long, red, hypertrophied scar extending from the mastoid downward and inward almost to the larynx. The disfigurement was not so great as in the preceding case, but it was sufficient to justify an energetic attempt at its removal. The result, at the end of 4 months, is eminently satisfactory, the scar being small, soft, not red, and freely movable over the fascial graft.

There is theoretical ground, at least, for assuming that the horrible deformities due to the hypertrophy and contraction of burns, especially about the neck, may, in appropriate cases, be relieved by the intelligent use of fascial grafts. It does not seem likely that the method can be of much, if any, value with true keloids.

RUPTURE OF THE BICEPS FLEXOR CUBITI *

WITH A REPORT OF EIGHT CASES

By Emory G. Alexander, M.D.

of Philadelphia

Associate Surgeon to the Episcopal Hospital

Rupture of the biceps muscle or its tendon is a rather rare accident. It may be of interest to the Academy, therefore, to present eight of these cases, especially as five were operated upon and the exact location of the rupture was determined. Literature reviewed on the subject cites only 74 cases, 5 of which were operated upon.

Case I.—M. C., aged twenty-six years, white, male, laborer. Admitted to the Episcopal Hospital January 9, 1914.

History.—On the day of admission, while at work cleaning out an endless chain elevator shaft, the elevator suddenly started and one of the buckets caught his right arm, crushing it against the side of the shaft. He was held in this position for forty-five minutes before being liberated. The shock following the accident was so great that it was necessary to remove him to the hospital in the ambulance. On admission to the hospital the patient was in a state of severe shock. He was unable to raise the right arm or flex the forearm.

Examination.—Showed a contused wound of the right chest wall and right arm. No bones were broken. The right arm anteriorly from the shoulder to the elbow was markedly swollen and ecchymosed. On deep palpation over the upper part of the biceps, where the swelling was greatest, a distinct furrow could be felt. This furrow was about the width of the index finger. The width of the furrow could be increased by extending the forearm. On account of the great swelling of the arm no bulging appeared at any point over the biceps on extending or flexing the forearm. A diagnosis of rupture of the belly of the biceps was made and an operation advised. On account of the bruised condition of the tissues the operation was postponed for several days.

On January 11, 1914, under ether anæsthesia, the patient was operated upon and a rupture of the belly of the short head and a partial rupture of the belly of the long head of the biceps were found. The ends of the muscles were properly approximated

* Read before the Philadelphia Academy of Surgery, January 4, 1915.

FIG. 1.—Case I. Five weeks after operation.

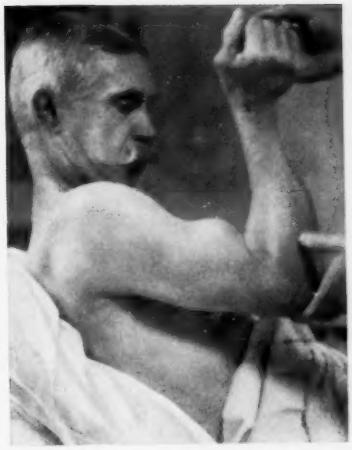

FIG. 2.—Case II. Before operation.

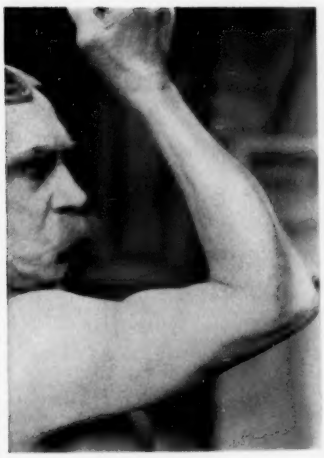

FIG. 3.—Case II. End result.

FIG. 4.—Case V. Before operation

and sutured with twenty-day chromic catgut. The arm was dressed with the forearm in flexion, so as to relieve any strain on the sutured muscle. Primary union followed. Firm union took place between the ruptured ends. This could readily be determined by grasping the biceps over the seat of rupture and flexing and extending the forearm. On account of the marked atrophy of the humeral group of muscles which followed the accident, the return of power in the patient's arm was very slow, and massage and electrical treatment were given. At the time of his discharge from the hospital the biceps still showed marked atrophy, but the patient had good use of the arm and forearm. The usefulness of the arm has steadily improved and the patient is now able to follow his usual occupation.

CASE II.—F. L., aged fifty-three years, white, male, cloth finisher. Admitted to the Episcopal Hospital on January 16, 1914.

History.—In 1910, while putting a large belt on a fly-wheel, he lost his balance and fell, striking his right shoulder and arm against a machine. When he struck the machine he felt something give way in his arm, experienced a sharp pain at this point, and heard "a sound like the report of a revolver." Immediately his arm became swollen, "black and blue," and a "lump" appeared at the lower part of the arm over the belly of the biceps. For a short time following the accident he was unable to use the arm. He consulted a physician for the injury, who prescribed a liniment. No fixation apparatus was applied. The ecchymosis and swelling disappeared in one or two weeks, but the "lump" remained. He continued working at his trade but his arm was so weak that he finally gave up his position and sought an easier one. Since the accident he has been able to do only light work, as his forearm under muscular effort will often give way. The weakened condition of the arm and forearm has persisted, although he has been treated with electricity, massage, etc. He has never had rheumatism, gout, typhoid fever nor lues.

Examination.—His right arm, when either the forearm was flexed or extended, showed a marked bulging of the belly of the biceps. The bulging was greatest when the forearm was forcibly flexed to a right angle and the flexion strongly resisted. The entire biceps muscle was soft and flabby. Above the belly of the biceps, which terminated very abruptly, it was impossible to feel the tendon of the long head. There was no difference in the power of flexion of the forearm, whether it were supinated or pronated. A diagnosis of rupture of the tendon of the long head of the biceps was made. As four years had elapsed since the accident it was with some hesitancy that an operation was advised, but as

the patient was practically incapacitated it was hoped that an operation might better his condition.

On January 19, 1914, under ether anæsthesia, he was operated upon. An old rupture of the tendon of the long head at its junction with the belly was found and fibrous union had taken place between the tendon and the muscle. This cicatricial tissue, about one and one-half inches, was excised. The end of the tendon was split for about three-quarters of an inch and the muscle brought in between the two ends of the split tendon and sutured with twenty-day chromic gut. The arm and forearm were dressed as in Case I. Primary union followed.

The case progressed most favorably and the patient now states that he has been much benefited by the operation. A slight bulging still persists at the site of the old rupture.

CASE III.—P. McC., aged sixty-one years, white, male, punch helper. Admitted to the Episcopal Hospital on March 21, 1914.

History.—The patient came to the Medical Dispensary of the hospital on account of pain (rheumatism) in his right shoulder and weakness of his arm. In examining him the physicians found that he had, besides a chronic articular rheumatism, a rupture of the biceps muscle. Although the bulging was very great the patient had never noticed it. The patient stated that about six weeks before he came to the dispensary for treatment, while at work in a punch shed, he tripped and fell, striking his right shoulder. The injury caused him some pain and was followed by some stiffness of the shoulder. Since the accident he has noticed that his arm and forearm are weaker and that the weakness is increasing.

Examination.—Symptoms similar to Case II, the only difference was that in this case the bulging was greater and the muscle more flabby. Hüter's sign was not present.

On March 26, 1914, the patient was operated upon and a rupture of the tendon of the long head at its junction with the belly found. I was unable to find the tendon of the long head although I searched for it up to the bicipital groove. I did find a fibrous sheath, which I took to be the sheath of the tendon; there was, however, no tendon within it. As the sheath was not strong enough to suture the muscle to, the stump of the belly of the long head was sutured to the tendon of the short head.

The patient's arm was treated as in Case II. Primary union followed. Anatomically, the patient does not appear to be very much benefited, as he still has quite a bulging of the muscle. Functionally, he has been greatly improved and now says he is sure he is able to return to his former work, which he had had to give up on account of the weakness of his arm.

This patient, I feel sure, ruptured his biceps muscle much longer ago than six weeks before the operation. The interesting point is that although he had quite a bulging of the muscle he had never suspected any trouble.

CASE IV.—G. C., aged fifty-three years, white, male, machinist. Admitted to the Episcopal Hospital April 27, 1914.

History.—Six months before admission, while working on a lace curtain machine, he attempted to stop the wheel by catching it as it revolved. He succeeded in stopping the wheel, but it gave his shoulder quite a " wrench " and he felt something " give way " in his arm and heard " something snap." On flexing the arm he noticed a bulging over the biceps. Although he noticed that his arm was much weaker the accident did not completely disable him. The weakness was progressive and for this reason he came to the hospital. There was no history of gout, rheumatism, typhoid fever or lues.

Examination.—Symptoms similar to Cases II and III. Hüter's sign was present. (Hüter calls attention to the fact that flexion of the forearm in pronation when the biceps is tense is more forcible than when the forearm is supinated and the biceps is relaxed.) On April 20, 1914, under ether anæsthesia, the patient was operated upon and a rupture of the tendon of the long head at its junction with the belly found. The tendon was readily found, but it appeared more as a small fibrous cord than as a tendon. On account of the weakened condition of the tendon, I did not think it advisable to suture it to the muscle, but instead, sutured the belly of the long head to the tendon of the short head. The case was treated as the preceding. Primary union followed. The patient has a very satisfactory result. There is very little bulging of the muscle on forced flexion of the forearm and the arm and forearm are much stronger than before the operation.

CASE V.—W. S., aged forty-one, white, male, laborer. Admitted to the Episcopal Hospital on December 9, 1914.

History.—On the morning of admission to the hospital, while lifting a bag of coffee, he was suddenly seized with pain and heard something snap in his left arm. He said it felt as if " somebody had hit him with a club." As he was unable to use his right arm after the accident, he came immediately to the hospital. There was no history of typhoid fever, gout or lues, but an indefinite history of a mild attack of rheumatism in the left shoulder.

Symptoms were those of a rupture of the long head of the biceps. No hæmatoma or other signs of recent injury were present. Hüter's sign was not present.

The patient refused to be operated upon and left the hospital the same day that he applied for treatment.

This patient was operated upon one week after the accident by Dr. G. G. Davis at the University Hospital. The operation disclosed the tendon of the long head relaxed. A rupture had taken place at some point between its origin and the bicipital groove. The tendon was not pulled out of the groove, but the slack portion was taken up and the tendon sutured to the tendon of the short head.

CASE VI.—R. McF., aged sixty years, white, male, fish dealer. Admitted to the Episcopal Hospital on December 15, 1914.

History.—Three months before admission, while attempting to lift a barrel of fish, he was suddenly seized with a severe pain in his left arm. He dropped the barrel and rested the arm for a few minutes until the pain subsided. The night following the injury he suffered greatly with pain in his arm, forearm and fingers. Since the accident, on account of the weakness of his arm, he has been unable to do heavy work. He says that his left arm frequently "goes to sleep." No history of typhoid fever, rheumatism, gout or lues, but is a heavy whiskey drinker.

Examination.—Symptoms similar to Cases II to V inclusive. Hüter's sign not present. The muscle showed quite a bulging and was very flabby. Blood-pressure 180 systolic. No symptoms of nerve involvement.

Diagnosis.—Rupture of the long head of the biceps, probably at the junction of the tendon and muscle. As the patient was in very poor physical condition no operation was advised.

Besides the six cases reported above, two other cases have been treated this year in the Medical Dispensary of the Episcopal Hospital.

CASE VII.—Wm. M., aged eighty-four years, white, male, insurance agent. This case came to the Dispensary on account of a traumatic arthritis of the left knee. In the examination of the patient it was discovered that he had a rupture of the long head of the biceps muscle of the left arm. The probable seat of rupture was at the junction of the muscle and tendon. The Dispensary notes state: "No symptoms at time of rupture or afterwards; no history of rheumatism, typhoid fever or lues."

CASE VIII.—Wm. L., aged fifty years, white, carpenter. The patient was admitted to the Dispensary for treatment for chronic endocarditis and myocarditis. He was treated six years ago in the Episcopal Hospital for a severe attack of acute articular rheumatism. The lesion in this case was of the long head of the biceps of the left arm. The rupture, as in Case VII, was probably at the transition point between tendon and muscle. This case, as the preceding, had "no symptoms at time of rupture or afterwards."

Unfortunately, in the above two cases, no note was made as to whether the patients were right- or left-handed.

Loos [1] reports 66 cases of rupture of the biceps, 44 of which were of the muscle, and 18 of the tendon. Four of these were his own.

Petit,[1] according to Loos, collected 83 cases. In this series the point of rupture was as follows: Muscle 21; belly of the long head 9; tendon of the long head 43; at junction of belly of the long head and tendon 7; the tendon of insertion 3. I failed to find an article on the subject by Petit, so was unable to verify the statistics as given by Loos.

Wiesmann [2] reviews the literature on this subject and reports a case of rupture of the tendon of insertion caused by the lifting of a table. He operated upon the case and obtained a successful result.

Davis [3] reports 4 cases, as follows: Rupture of the tendon of the long head 3; rupture of the tendon of insertion 1.

Castret [4] reports a case of rupture of the belly of the biceps due to slight muscular contraction. The case was treated by electricity.

Hollos [5] reports "two cases of biceps rupture by paralysis." I have been unable to find his article.

Keen [6] reports a case of rupture of the tendon of the long head and also one of DaCosta's, of a tearing off of the long head from the margin of the glenoid cavity. Both of these cases were successfully operated upon.

Gerster [7] reports a case of laceration of the long head of the biceps due to a fall down stairs. The case was successfully treated with a sling.

In 64 of the cases reported, in which the histories were given in sufficient detail to locate the lesion, 16 occurred in the tendon, 44 in the muscle, and 6 at the junction of the tendon and the muscle. As only 5 of the cases reported were operated upon the exact site of the rupture in the others could not be ascertained.

Davis [3] believes that true rupture of the tendon is rare and "when a tendon does rupture it is very likely to have been diseased." In Case IV of this series it appeared as if the tendon was either diseased or malformed.

From the cases reported it appears that rupture may take place through the belly of the long or short head, through the belly of the muscle proper, at the transition point of the belly and tendon, through the tendon of the long head or the tendon of insertion, and even as in DaCosta's case, at the origin of the tendon of the long head.

Of the cases reported, 4 have been the result of muscular effort alone. Only 2 cases are reported in which the accident occurred in women. Only 2 cases are reported of rupture of the belly of the short head; one of these was due to direct injury, a threshing machine accident, in which the belly of the short head and the tendon of the long head were both injured, an accident very similar to Case I of

this series. The other case occurred in an attempt to reduce a dislocated shoulder.

The causes of the rupture may be either direct force, muscular contraction, or possibly an indirect force, such as a fall on the shoulder, that would throw a great strain on the long tendon; also disease or malformation might be an underlying cause.

Since the great majority of the cases occur among working men, and since the right biceps is the one usually affected, it seems that muscular contraction is the most potent etiological factor.

In Cases II, III and IV of this series the rupture occurred at the transitional point between tendon and muscle. As tendon is stronger than muscle it is natural to believe that the rupture occurred on the muscle side of the tendon and that the underlying cause might possibly have been a myositis. This cause is suggested in Case III, where the entire muscle was markedly relaxed and very flabby, although only the tendon and belly of the long head were implicated in the accident. The cases reported show that rupture is most apt to occur after forty years of age. As this is the period that degenerative tissue changes are most apt to make their appearance it is very probable that disease of muscle or tendon plays a very important causative part in the rupture.

That rupture of the tendon or belly of the long head is more frequent than at any other site, I believe to be due to the fact that the tendon, by its position in re-inforcing the shoulder-joint, is subjected to all strains that may be thrown upon the head of the humerus. Cases II and III may have occurred in this manner.

The symptoms at the time of injury may be trivial, the patient noticing nothing wrong, or they may be quite severe and immediately incapacitate. Swelling and ecchymosis do not always accompany the rupture.

The physical findings will differ somewhat, depending on the site of the rupture. If the rupture is through the belly of the muscle a furrow can be felt between the two ends, this can be widened by extending the forearm. In rupture of the tendon of insertion, flexion and supination of the forearm may be interfered with and the belly of the muscle would be drawn up nearer the shoulder.

In rupture of the long head, whether it be a tearing away at its point of origin, in the continuity of the tendon, at the transition point between tendon and muscle or through the belly of the long head, the symptoms are almost identical. A bulging of the biceps at a point nearer the elbow than normal, a flabby condition of part or all of the muscle, an abrupt termination of the bulging above and an inability

to feel the tendon above that point, all point to rupture of the muscle or tendon. In rupture of the tendon or muscle of the long head the short head stands out prominently, and to its outer side, where the long head and tendon should be, a sulcus running upward and slightly inward is found.

Hüter's symptom was present in only one of this series. It was not tried for in Case I.

The treatment in the great majority of cases has been either none at all, or bandage, sling, electricity, etc. No doubt many cases have been operated upon. I have only been able to find, however, 5 cases treated in this manner.

Von Hochstetter[8] reports a case of a man forty-six years of age, who ruptured the tendon of the long head at its junction with the belly. This case was operated upon two months after the injury. The tendon was sutured to the belly with silk. Result successful.

Bazy[9] reports a man, aged forty years, who ruptured the tendon of the long head at its point of origin. He operated upon this case, resected the tendon, and sutured the stump to the tendon of the short head. Result successful.

Keen[6] reports a case of a man, aged fifty-four years, who ruptured the tendon of the long head. The tendon was sutured with twenty-day chromic gut. Result successful.

DaCosta,[6] reported by Keen, operated upon a man, aged fifty-two years, who in lifting a bucket tore the tendon of the long head away from its point of origin. In this case the upper portion of the tendon was resected and the stump was attached to the short head by splitting the latter and suturing. Result successful.

Wiesmann[2] reports a case of rupture of the tendon of insertion, caused by lifting a table. The case was successfully operated upon.

Conservative methods of treatment have given satisfactory results in a few isolated cases only. Since successful results have been gained by operation in cited cases, it is evident that the operative treatment is to be recommended.

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THE USEFULNESS OF VENTRAL DECUBITUS IN SOME LEG AMPUTATIONS

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In amputation of the limbs position plays an important part. By manipulation of the distal end we may obtain whatever attitude it may seem best to impress upon the limb during the intervention. If position is neglected it may be difficult to execute various movements which require some energy, as, for example, in the case of amputation of the leg, the rotation of the limb or elevation of the extended leg. In cases of amputation of the forearm, attention to this precaution is easier because of the convenience with which the operator may observe the effects upon the flap which he is raising of extension or flexion, of pronation and supination. The reverse is the case in operations on the leg.

In the dorsal decubitus, the muscular mass which has to do with flexion of the leg is behind, but if the patient is placed in the ventral decubitus, these muscles become superior and one is able to control them in the flap with ease. Such a position also facilitates post-operative examination and attention.

In cases of reamputation of the stump of the leg in the position of ventral decubitus, anæsthesia is easy and well borne—the usual prejudice to the contrary notwithstanding.

The healthy limb should be allowed to fall to one side of the table so that the stump to be reamputated may be upon a superior plane. The usual antisepsis is understood to be observed.

First Step.—Stump in extension, raising of the posterior flap. This step is particularly easy with the ventral decubitus. In the subcutaneous tissue the external saphenous and three or four vessels inside of the triceps are met with. The triceps is divided transversely and after section it contracts, uncovering the large vessels and nerves of the calf, which are identified and divided. The deep muscles in the interosseous space are then divided, the peroneal artery or its branches is ligated. The flap thus made is then carefully raised from the interosseous membrane to the level chosen for the section of the bone. The interosseous membrane is cut across at the level of the inferior edge

FIG. 1.—The patient is in ventral decubitus. The leg to be operated upon is in flexion. Guyon's tube rolled up.

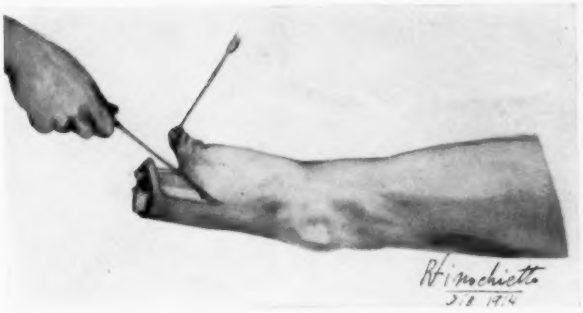

FIG. 2.—Reamputation of a stump of the leg; the stump in extension while the posterior flap is being raised.

FIG. 3.—*Idem.* Stump flexed to a sharp angle. Raising up of the anterior flap.

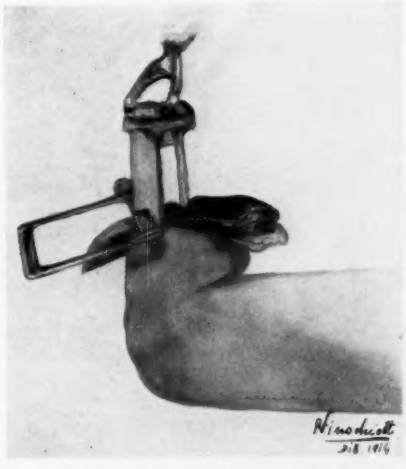

FIG. 4.—*Idem.* Stump flexed to a right angle. Sawing of the bones; toilet.

of the flap and lifted out from the interosseous space after the division of its attachments to the tibia and fibula (Figs. 1 and 2).

Second Step.—Stump sharply flexed, raising of the anterior flap. The assistant flexes the stump, after which the operator makes his flap, cutting the internal saphenous vein and the anterior tibial artery. The flap of the interosseous membrane already made is of marked assistance in this step, and by its preservation the artery is protected (Fig. 3).

Third Step.—Stump flexed to slight angle. Section of the bones. In this position the flaps with their hæmostatic forceps fall to one side or the other of the bones, facilitating not only the classic section of the bone, but also the sawing out of a piece of bone, the taking out of a periosteal collar, the scooping of the marrow, etc. (Fig. 4).

Fourth Step.—Toilet and Suture: The position of the stump will vary according to the method employed. Forced flexion when the longest flap is the posterior one. Extension when the anterior is the longest. Intermediate when both flaps are equal.

In a Turkish amputation the ventral decubitus is of real advantage. This kind of amputation is generally done in patients of lessened resistance and in limbs in which the circulation is abnormal, as the result of inflammation. The ventral position of the leg sensibly reduces the hemorrhage. The section of the muscles is under plain inspection. The vessels are very easily appreciated and the nerves are more apparent in the intermuscular spaces. Rapidity, very little bleeding, clean section—these are the desiderata of the Turkish operation, which are more perfectly secured by the ventral position.

In a primary amputation of the leg in its upper two-thirds ventral decubitus will afford increased facilities in the various steps of the toilet and in the application of the sutures.

In these steps two important technical details are to be observed. The first is the isolation of the infected part when the amputation is done for septic conditions. The second is the rolling up of an elastic tube (Guyon) immediately distal to the operative zone (Fig. 1). Such a tube renders unnecessary the employment of forceps to the peripheral end of the veins, which forceps would be in the way at the moment of the sawing of the bones.

Conclusions.—In cases of amputation through the upper two-thirds of the leg, examinations, operations and dressings should be done while the patient is in the ventral decubitus. All classes of anæsthetics can be administered and will be perfectly tolerated in that position. While in this position flaps of any form can be raised and one may

employ at will subperiosteal, periosteal, anaperiosteal and osteoplastic methods.

Any method of amputation can be performed more easily while the patient is in the ventral decubitus. Equally well in the same position any condition which involves all or a greater part of the leg circumference, as ulcer, lymphangiomata, cirsoid aneurisms, etc., may be examined and operated upon.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

Stated Meeting, held at the New York Academy of Medicine, January 27, 1915

The President, Dr. Frederic Kammerer, in the Chair

SUBSCAPULAR EXOSTOSIS WITH ADVENTITIOUS BURSA

Dr. Clarence A. McWilliams presented a girl, aged 18, who had come to his office in the early part of last August, complaining of dull, aching pains in the left shoulder, increased by wet weather and by use. The pain seemed to run down irregularly through the deltoid muscle, and varied much in intensity, duration and frequency. It was never a completely disabling pain. It had been present for about a year and was getting worse. Twelve years ago, following a fall, the left scapula began to become prominent. For this she wore a brace for a year, but without any benefit. The projection of the scapula backward was increasing. Just inside the posterior edge of the left scapula a swelling had appeared, varying in size from time to time, but never becoming larger than a lemon. No redness appeared over the swelling, which was very slightly tender. Motions of the shoulder itself were painless and unrestricted. The drawing of the scapula backward and forward was slightly painful, and for a year the patient had noticed on attempting this motion a grating or creaking sound.

The posterior edge of the left scapula was very prominent. There was no depression on its inner side, as would have been the case had the muscles been atrophied from paralysis. Instead, there was a fulness at the lower part of the posterior edge of the scapula. The color of the skin in this location was normal. Palpation revealed an indefinite, soft, doughy swelling of about the size of a lemon, the edges of which could not be mapped out. There seemed to be a sense of fluctuation in it. It appeared as though it ran forward beneath the scapula. The feeling was as though a cyst was present beneath the scapula. A röntgenogram was taken, which at once explained the condition. An exostosis (Fig. 1) on the inner side of the lower part of the left scapula was surrounded by an adventitious bursa.

On August 12, 1914, a transverse incision was made about 1½ inches above the inferior spine of the scapula. A transverse incision was made in order to afford as little disfigurement as possible when a low-cut dress was worn. The trapezius fibres were separated in their direction, and the rhomboid was divided. Under its surface a thin-walled cyst was found. In the attempt to enucleate this it was ruptured. It contained serous fluid. The finger inserted came on an exostosis which began about 1 inch from the posterior border and ran obliquely forward and inward. With a chisel it was an easy matter to divide the narrow pedicle at its base. This pedicle was much narrower at its base than at its distal extremity, as shown in Figure 2. The end of the exostosis was irregularly rough. The chest-wall on which the exostosis impinged was very rough and covered with thickened, hard connective tissue. The bursal wall was dissected out as far as possible, and, in order to obliterate any of the wall which might have been accidentally left, the space was packed with dry, sterile gauze. Separate suture of the muscular layers was made about the gauze.

Pathological examination (by Dr. Whipple) revealed the following: Gross examination: There are two specimens. The first is an oval-shaped piece of bone, measuring 2.05 cm. in one diameter by 2 cm. in the other, and about 1.05 cm. in thickness. Covering it is an irregular patchy area of cartilage which is fairly smooth, with irregular edges. Considerable resistance is encountered on section. The second specimen appears to be the remains of a cyst, covering the exostosis. The cyst-wall is markedly thickened and the inner edges show a considerable amount of infiltrated blood.

Microscopic examination: The sections taken through the exuberant growth of the scapula show that the tissue is made up partly of cartilage and partly of bone. The interesting feature of the section is the picture of metaplasia occurring from cartilage to bone. Covering the cartilage in places is, apparently, a thin layer of fibrous tissue. The sections from the cyst which covered the exostosis show an unusual picture of adventitious bursa, in which the cyst-wall is made up of fairly dense fibrous tissue and the lining of modified connective-tissue cells, the innermost cells being fairly parallel to the surface of the cyst. Diagnosis: Exostosis of the scapula, with adventitious bursa.

The wound healed by primary union. Two weeks elapsed before the gauze was loose enough to be removed. Now five months after the operation the appearance of the shoulder is perfectly normal, the scapula having resumed its normal position. The grating sound has disappeared, and all motions are painless.

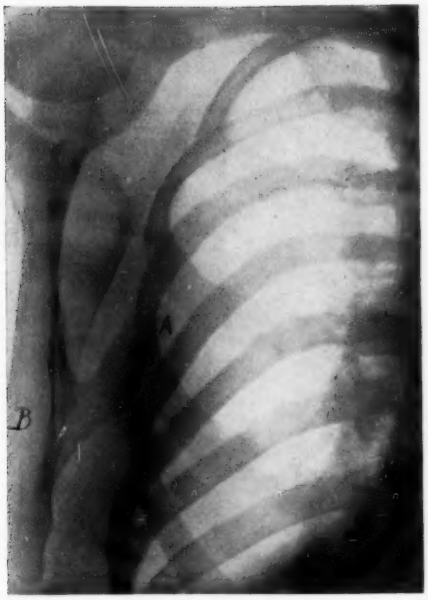

FIG. 1.—*A B*, exostosis.

FIG. 2.—Exostosis after removal. *A*, free end; *B*, pedicle with oblique cut surface.

FIG. 3.—Defect in lower jaw; result of necrosis.

FIG. 4.—After removal of wires on fiftieth day. Shows marked periosteal growth of new bone. Firm union.

PERFORATED GASTRIC ULCER FOLLOWED (TWO WEEKS) BY GASTRO-ENTEROSTOMY FOR DILATATION

DR. MCWILLIAMS presented a woman, 24 years of age, who was admitted at 3 P.M. on December 10, 1914, with a temperature of 101 degrees, pulse of 105, with white blood cells 31,000, polymorphonuclears, 91 per cent. She had been seized, five hours previously, while walking upstairs, with severe, agonizing, sharp pain in the epigastrium. This was located at first to an area the size of a silver dollar, but later became diffused over the upper part of the abdomen, radiating into back and shoulders. All movements in bed increased the pain. This initial pain was almost immediately followed by weakness and a feeling of faintness, with collapse and profuse cold perspiration. Her past history was that for three years she has had attacks of nausea, vomiting, and the belching of gas, which came on from two to ten hours after eating, always relieved by vomiting. Ten months ago she was in one of our large best hospitals, where she was told that she had a gastric ulcer. During two weeks of the time that she was in this hospital she had seven hemorrhages of dark red blood from the stomach. During the past three years she has had burning pain in the epigastrium, coming on from one to two hours after meals, and lasting until she vomited. While in the hospital she was treated for a number of weeks with Einhorn's duodenal bucket.

Physical examination by Dr. McWilliams revealed an abdomen which was rigid all over, but more intensely so in the right upper quadrant, where there was also acute tenderness. No fluid could be made out in the abdomen, and the entire liver dulness was obliterated.

Operation was performed five hours after the onset. Gas was administered, supplemented later by a few drops of ether, and the principle of anoci association was employed in opening the abdomen, novocain being injected into the skin, aponeurosis, rectus muscle and peritoneum. This was supplemented by injecting urea and quinine solution along and into the rectus muscle an inch away from its incision. On opening the peritoneum there was no escape of fluid, and the congested stomach presented. On drawing the stomach to the right, fluid escaped in considerable amount. Through the stomach was felt an induration on the posterior wall, about an inch and a half proximal to the pylorus, of the size of a silver dollar. The lesser omentum was opened with the finger, and the posterior wall of the stomach rolled out into sight. A perforation about the size of a knitting needle was seen about an inch from the lesser curvature, in the centre of the induration. The stomach was very large, seemed atonied, and was full of

fluid. Some of this fluid had extravasated into the lesser sac and had then gone through the foramen of Winslow, collecting deep in Morrison's pouch. The stomach was so large that it overlay this free fluid. There were no adhesions anywhere. The perforation was closed by Lembert sutures of silk, and was covered by a tab of fat from the lesser omentum. The finger was passed through the pylorus easily by invaginating the stomach before it, and there was no organic stenosis. In view of the situation of the ulcer away from the pylorus, a gastroenterostomy was deemed unadvisable. The gutter to the outer side of the ascending colon and the pelvis were flushed out with salt solution. In the pelvis was some fluid, but since there were no food particles in this fluid the abdomen was closed without drainage. The immediate convalescence was very smooth. The urea and quinine injection into the muscle seemed to much decrease the local pain in the wound, none being complained of, and the post-operative distention was practically nil. Nothing was given by the mouth for three days, during which time the Murphy drip was employed. During the first twenty-four hours 10 pints of fluid were taken up by the rectum, and 12 pints in the second twenty-four hours. There was no vomiting until the third day. On the second day pituitrin, 1 c.c., was administered hypodermically, every four hours, and a colon irrigation was given twice daily. On the third day the patient vomited three times. At 10 P.M. of that day there was considerable upper abdominal distention, due to a distended stomach. A tube inserted evacuated 2,500 c.c. of thick, brown fluid. There was much relief following this procedure. There was no vomiting on the fifth, six or seventh days, but on the eighth day the patient vomited 1,200 c.c., and on insertion of a tube 1,600 c.c. of fluid were evacuated by siphonage. For the next three days the stomach was washed out twice a day and each time, on insertion of the tube, from 600 to 1000 c.c. of fluid was evacuated by siphonage. The wound healed by primary union. On the twelfth day röntgenograms were taken of the stomach. The plates showed a large stomach with strong peristaltic waves. The antrum was of enormous size. The stomach outline showed no evidence of ulcer. The duodenal shadow was not evident at all. Three hours after a bismuth meal more than one-half the ingested bismuth remained in the stomach, six hours thereafter more than one-quarter of the bismuth, while after twenty-four hours a great deal of the bismuth still remained in the stomach. Some of the bismuth seemed to go through the pylorus even after three hours, but most of it appeared to stop abruptly at the pylorus.

The question was whether there was a simple dilatation from atony of the stomach, or whether the dilatation was dependent on obstruction of the pylorus due to spasm. It seemed more than reasonable to suppose that spasm, caused by the ulcer, was responsible for the mechanical obstruction, so, fourteen days after the first operation, Dr. McWilliams did a posterior gastro-enterostomy with suture. The stomach was large and dilated. There was no organic stenosis of the pylorus, as a finger could easily be passed through it. The induration of the ulcer could readily be palpated. There was no other ulcer present, either in the duodenum or in the stomach. The ulcer did not seem to impinge on the pylorus. The site of the old perforation was adherent to the under surface of the liver, but there were no other adhesions.

Convalescence was smooth and uninterrupted. Röntgenograms taken three weeks after the gastro-enterostomy showed a marked change for the better. Prior to the operation there was a marked retention of bismuth after six and twenty-four hours. Three weeks after the operation the amount of bismuth remaining in the stomach after six hours was just about one-half that remaining prior to the operation, while after twenty-four hours there was none whatsoever remaining in the stomach. This was a great improvement. Since the gastro-enterostomy, now about five weeks ago, there has been no vomiting nor any discomfort, and the patient could eat everything. From all the evidence it would seem that the dilatation was due to obstruction caused by the pyloric spasm.

BONE GRAFT FOR OSTEOMYELITIC DEFECT OF LOWER JAW

Dr. McWilliams gave the history of a patient whom he presented, a woman, 33 years of age, who had been sent to him by Dr. Downs. Her chief complaint was of displacement of the lower jaw and inability to chew. Two years ago she had pneumonia. Four months afterward two small, hard lumps appeared on the under surface of the lower jaw. These were not painful until two months after their onset, when she had pain like a toothache, and both lumps discharged, one on the inside and the other on the outside of the mouth. She went to a hospital where, during a curetting of the bone, the jaw was accidentally fractured. For four months a plaster-of-Paris bandage was worn, during which time pieces of bone were discharged. Two of them were over an inch long. Bacteriological examination showed that the infecting organism was the pneumococcus. Nine months ago the larger right fragment of the lower jaw was wired to the upper so as to prevent its

displacement inwards and backwards, so that chewing has been impossible. The sinuses have all been healed now for some months.

Physical examination clearly revealed the defect (see Fig. 3). The horizontal border of the vertical portion of the bone ended in a triangular point. The right half of the bone ceased at the left canine tooth, leaving a defect of about an inch and a half to be filled in. The teeth of the right half were held in place with regard to the upper jaw by wires, so that the right side was in perfect alignment with the upper teeth.

The first operation was undertaken on November 6, 1914. In making an incision great care was taken to prevent going through the mucous membrane into the mouth. The tissues were very adherent to the bone, from which they were stripped with the elevator. The triangular tip of the vertical half, along the dotted line BC, was removed. The necessary mobilization of the posterior fragment was accomplished only after the entire surrounding tissues were stripped from the bone by the elevator on its outer and inner sides, extending up as high as the condyle. Fear was entertained for the future blood supply of the bone, but this anxiety was subsequently proved to be needless. The fragment was sutured in its posterior position. The motion, even with this extensive separation, was not yet free enough, so the coronoid process was divided at its base with a chisel. The motions of the fragment were then perfectly free, showing that the temporo-maxillary articulation was free and uninvolved. The fragment was then fixed in its proper posterior position with chromic gut, and the skin was closed without drainage. Healing was by primary union. The wires holding the right fragment were removed at the time of this operation.

The question of the best method of holding the fragments was placed in the hands of Dr. Henry S. Dunning and Dr. V. E. Mitchell, who made an interdental splint which held both fragments in their proper relations. Eighteen days after the previous operation, a bone graft was inserted to fill up the defect. Great care was taken, in making a furrow to lodge the graft, that the cavity of the mouth was not opened into. The finger of an assistant in the mouth was a great help in preventing the opening of the mucous membrane. A graft of the requisite length was taken from the tibia, with its periosteum. The periosteum was cut larger than the bone section and reflected back onto the graft. The ends of the fragments of the lower jaw were freshened with the chisel, and each was drilled, as well as both ends of the graft. The graft was forced into place between the ends of the

fragments, and aluminum bronze wires were inserted and twisted and the ends cut off. Wires were used because it was feared that the strain on catgut would be too great. The skin was closed with silk without drainage. A bandage was placed about the lower jaw so as to hold it immovable against the interdental splint on the upper jaw.

A week after the operation a little serous discharge appeared in the front of the incision and in a few days this became purulent. There was never at any time any temperature. The discharge never amounted to more than three or four drops, but was purulent.

On the fiftieth day after the operation, using novocain locally, the speaker removed both wires. The anterior wire was the only one infected, but for safety's sake both were removed, since they had done their work by this time. The graft looked smooth and pink and seemed to be perfectly alive, and was fast in its position (Figure 4). The posterior wire was imbedded tightly in connective tissue, and there was no fluid exudate about it. The anterior wire, on the contrary, was surrounded by granulation tissue and there was some purulent exudate about it and in the meshes of the granulation tissue. Were he to do this same case over again, notwithstanding the infection, he would use wire again rather than catgut, since there was so much pressure on the graft, which was wedged in, which would tend to displace it. The slight amount of infection, in his opinion, will not injure the life of the graft. The wires remained in place long enough to accomplish their purpose, that of holding the graft in its proper place until it should become fast.

An interdental splint was chosen rather than fixing the right larger fragment against the upper teeth with wires because it was deemed best to form the interdental splint so that it would exert a pressure upon the smaller left fragment to force it backwards. In addition wires become continually loose. Since the anterior end of the posterior fragment was free, there was a constant tendency for it to be drawn forwards by the action of the muscles. The pressure of the splint on the soft parts overlying the fragment in the mouth, it was hoped, would overcome this tendency.

A röntgenogram (Fig. 4) taken immediately after the wires were removed (fifty days after the grafting) showed that the graft was much larger than the original graft, due to the proliferation of the periosteum, which, at the time the graft was taken from the tibia, was purposely cut larger than the bone section itself. Where one wishes a graft to increase in size, it is advisable that the periosteum be as voluminous as possible. Experience has shown, however, that, when this patient begins to use her jaw in chewing, nature will respond to

the extra strain on the living graft by causing it to grow to a size necessary to sustain all force put upon it. During this period of increasing growth care must be taken that the force shall be gradually increased, and that no sudden great strain be put on the jaw, in order that the graft be not fractured.

DR. E. M. FOOTE had observed that some patients who have lost a part of the lower jaw are able to increase their power of mastication to a considerable extent by the education of the muscles of the other side. In some instances he had noted as good mastication with the back teeth as if there were perfect alignment of the incisors.

TORSION WITHIN THE LESSER OMENTUM SIMULATING SUBACUTE PERFORATION OF A GASTRIC ULCER

DR. JOHN A. HARTWELL presented a woman aged 53, who came under his care in December, 1914, giving the following history:

For many years she had suffered from symptoms which had been diagnosed as arising from a gastric or duodenal ulcer. In 1911 a very severe hemorrhage took place and she was kept in the hospital for four weeks undergoing a dietetic cure for gastric ulcer. This resulted in a very marked improvement, but the symptoms were still present to a less degree, and gradually grew more marked. In October, 1914, she was again suffering a good deal, and on one occasion passed a large amount of tarry blood per rectum. Since that time the old symptoms had steadily increased. On December 15 she was seized with severe abdominal cramp which centered in the right side. This was accompanied with vomiting. The pain subsided somewhat, but two days later a second very severe attack occurred. Examination at that time showed a marked rigidity of the right side of the abdomen, and evidence of considerable pain. There was an area of marked tenderness in the upper abdomen, at the site of the pylorus. Temperature was 100. Pulse 64. White blood cells 10,000, of which 76 per cent. were polynuclears.

A diagnosis of subacute perforation of a gastric ulcer seemed reasonably certain, and operation was done under gas ether anæsthesia. The usual right rectus incision was made. In the lesser curvature of the stomach, near the pylorus, was a thickened area over which there was a mass of fat—apparently a tab connected with the lesser omentum —adherent to the stomach and twisted in such a way that it was practically gangrenous. On separating it there remained considerable thickening in the stomach wall which was ascribed to an old ulcer beneath. This portion of the stomach was accordingly resected between clamps,

and the defect closed. The procedure narrowed somewhat the lumen of the stomach near the pylorus, so that it seemed advisable to do a gastro-enterostomy. The usual no loop posterior operation was done. Examination of all other abdominal organs failed to show any abnormality.

The report on the portion of the stomach removed and the omental tab was made by Dr. Elser of the New York Hospital, who reported that " the specimens consist of a portion of the stomach wall and a piece of omentum about 2 cm. in diameter and 1 cm. in thickness. The appearance of the omentum suggests strangulation. The microscopical examination confirms this. The tissue is infiltrated with blood, and the interlobular septa are invaded by numerous pus cells. Microscopical examination of the stomach wall shows practically no changes in the mucosa or musculature. The outer coat is infiltrated with fibrin and blood which also cover the surface at this point."

Dr. Elser suggested the diagnosis of torsion of the omentum. There certainly was no evidence of ulcer in the portion of the stomach removed nor in the contiguous portions so far as these could be seen through the excision opening. The long standing history was, however, very indicative of ulcer, and the findings in the omentum could hardly explain these. The case was presented because the lesion found—a torsion of part of the lesser omentum—was unique in the experience of the speaker. It might easily be confused in its symptomatology with a subacute or acute gastric perforation.

CARCINOMA OF THE STOMACH. SUBTOTAL GASTRECTOMY

Dr. Hartwell presented a woman, aged 48, who had suffered from severe gastric symptoms for one year. She was admitted to Bellevue Hospital on December 29, 1914. Examination then showed a very distinct localized tenderness over the stomach, near the pylorus, and a tumor was indefinitely palpable. The gastric analysis showed normal acid content and no blood. The radiograph gave evidence of a defect in the gastric wall near the pyloric end, and this was made more evident by fluoroscopic examination.

Operation was performed on January 9, under gas ether anæsthesia. Incision through the right rectus line. The operation of Polya (*Zentrbl. f. Chir.*, July 1, 1911) was performed, using the Payr clamps. This procedure following the technic as described by Mayo (*Surg., Gynec. and Obstet.*, December, 1914) was remarkably easy of execution. It permitted the removal of the stomach well beyond the line of choice—more than could have been readily done had the method of a posterior

gastro-jejunostomy been followed. The post-operative course was unusually satisfactory, and in less than two days the patient was entirely free from pain. There had been no vomiting. The pathological findings at operation, and the report on the specimen made by Dr. Vance, the divisional pathologist, were as follows:

Pathological findings: "On the anterior wall of the stomach, just proximal to the pylorus, and extending to the greater curvature is an indurated ulcerated area about 3 cm. in diameter, through which could be felt a deep crater. Recent adhesions drew the stomach down to the pancreas. The lesion is definitely confined to the gastric side of the pylorus. There are two slightly enlarged lymph-nodes in the gastro-colic omentum near the pylorus. The histological examination confirmed the diagnosis of adenocarcinoma of the stomach."

Dr. John F. Erdman said the Pólya operation could be very nicely and quickly performed in cases of perforating duodenal ulcer. He had employed it in seven cases within the last six weeks, five of which were for ulcer duodenal and three for gastric carcinoma. He cited one case in which he resected about four-fifths of the stomach. He has about discarded the Payr clamps, using instead the Moynihan and Marots clamps, which he found more satisfactory in suturing the stomach, as these clamps are not as clumsy as the Payr's.

PACHYMENINGITIS HEMORRHAGICA INTERNA

Dr. Hartwell presented a man, aged 49, who was admitted to Bellevue Hospital on November 21, 1914. He had received a head injury on that evening. On admission there was a small scalp wound over the right eye, but no evidence of fracture. He was in partial coma, and gave evidence of being deeply intoxicated. On rousing him he showed great irritability. There was some muscular weakness in the left face and arm. The left abdominal reflex was absent and all other reflexes were increased. A spinal puncture withdrew 5 c.c. of fluid which contained no blood. There seemed some increase in pressure. The eye grounds showed some obscurity of the discs and a slight tortuosity of the vessels.

During the subsequent ten days he showed alternating improvement and retrogression. Some days he was quite clear in his mind and all the symptoms seemed subsiding—except that there always remained a varying amount of weakness of left face and arm, and the eye grounds did not become normal. He acknowledged being a heavy drinker. On other days he would lapse into complete irrationality, with a tendency toward coma, and the disability in the left side would grow more

manifest. During his more lucid intervals an inco-ordination in the movements of the left arm and asterognosis were made out. The blood gave a strongly positive Wassermann reaction, but the spinal fluid did not.

On December 12th all the symptoms *suddenly* showed a marked increase, and it was apparent that there had been a sudden increase of intracranial tension, with its maximum point over the lower post-rolandic area, and it was evident operation alone could give relief.

Anæsthesia was produced by the drop ether method, very little being required. A cutaneo-osteal flap, horseshoe in shape, 9 x 6 x 4 cm., was turned down, the hinge lying just above and anterior to the auditory meatus, and the broad part near the great longitudinal fissure over the Rolandic area. The bone flap was cut with the ordinary broad amputating saw into the inner table and then separated with a few taps on a broad astertome. This procedure required less than ten minutes, and was very easy of accomplishment. On exposing the dura it was seen to be under tension, without pulsation, and seemed much increased in vascularity. On incising it and turning down a similar flap to the bone flap there came into view a large disc-shaped clot with its maximum thickness of 3.5 cm. lying over the post-central and pre-central gyri, near their lower ends. The brain in this region was depressed a corresponding distance below the skull. The diameter of the clot was about 8 cm. and the circumferential portions were very thin. It was estimated to equal about 4 oz. The dura, in the portions where no clot existed, was about twice the normal thickness, and its under surface was markedly vascular, showing a velvety appearance. The clot was firmly adherent to the dura, and on this surface was completely organized. The surface of the clot next the leptomeninges was much more recent and did not adhere. There was no evidence of any trauma to the skull or brain. The leptomeninges were intact, and there was no escape of cerebrospinal fluid.

After removing the clot the operation wounds were sutured. The patient made a prompt recovery. All symptoms had subsided in about a month, during which time he had received mercury and iodide.

The microscopical examination of a small section of dura remote from the clot showed a chronic inflammatory thickening. There was an increase of connective tissue and a round cell infiltration. The dural surface of the clot showed a complete organization. There was a layer of fibrous tissue which was well vascularized, arteries, veins and capillaries all being present. The deeper portion showed only coagulated blood.

Dr. Norris diagnosed the condition as pachymeningitis hemorrhagica interna.

The case was shown because it presented evidence controverting an article published by Mr. Wilfred Trotter, in the *British Journal of Surgery,* October, 1914, in which he assigned trauma with hemorrhage as the etiological factor in this disease. He says the trauma primarily causes bleeding and that it comes from the veins passing into the sinuses from the brain, and that the term meningitis is a misnomer.

This case showed direct evidence of a meningitis at a considerable distance from the hemorrhage. The greatest extent of the hemorrhage was not contiguous to a sinus. The clot was directly vascularized from the dura. The course of the disease was therefore a primary inflammatory lesion of the dura. An increased vascularity of the under surface was an expression of this inflammation. A slight trauma started a vicious hemorrhage from these vessels and this slowly progressed as the older parts organize and new vessels form in them. The advance and retrogression of the symptoms so characteristically shown in this case were thus explained.

Dr. Hartwell said he had personally operated on three similar cases and the museum at Bellevue and the Cornell Medical College afforded additional autopsy specimens.

The term *pachymeningitis hemorrhagica interna* was therefore exactly descriptive and should be retained.

GASTRO-ENTEROSTOMY FOR GASTROPTOSIS

Dr. Frederic Kammerer presented a woman of 27, who had been suffering several years from symptoms of dyspepsia, accompanied by occasional vomiting and loss of weight. About six weeks before her admission to the hospital the symptoms became more acute. She had pain very soon after every meal, and began to vomit continually. The vomited material contained blood at times. When first seen by the speaker, last August, she was very much emaciated. Physical examination revealed a marked gastroptosis. An X-ray examination was impossible, owing to the fact that the patient could not retain any bismuth. At an exploratory operation a typical, so-called, water-trap stomach was found, the larger curvature lying almost in the pelvis and the middle of the lesser curvature being situated about three inches below the umbilicus. There was an extensive formation of bands about the caput coli and ascending colon; these were separated and an appendectomy was done for a very long and adherent appendix. A careful examination of the stomach failed to reveal anything suggestive

of an ulcer. The pylorus was found in its normal situation and there was no stenosis at this point. The stomach appeared as an elongated U-shaped tube, wider at its lowest point. An attempt was made to facilitate evacuation of the stomach by a posterior gastro-enterostomy (done on September 3), assuming that at least a certain degree of gastric atony was present. Exclusion of the pylorus was not practised. The condition was in no manner relieved by this procedure. The patient continued to vomit everything, and had to be kept alive by artificial feeding and hypodermoclysis. On September 25 the abdomen was reopened, and, upon finding a somewhat distended duodenum, an anastomosis was established between the afferent and efferent loop of the gastro-enterostomy. There was no improvement after this second operation. Vomiting persisted in spite of daily lavages, and artificial feeding had to be continued until October 26, when the patient was practically reduced to a skeleton. On this day, after several ineffectual attempts, the operator was able to introduce a tube into the jejunum and to begin feeding. (The position of the tube was controlled by X-ray examination.) This was continued for twenty-one days, when the tube had to be removed. On this day the patient was much improved. She now weighed seventy-five pounds, and she was able, after this, to take a little food by the mouth, which was rapidly increased in quantity, vomiting having entirely ceased. She left the hospital four or five weeks later in very good condition, being entirely cured of all her symptoms. To-night she weighs 108 pounds and is, to all appearances, in good health.

The speaker said he had shown this case to accentuate the difficulties in determining the curative factors in many of these cases of gastroptosis in neurasthenic individuals, who had been subjected to operative procedures on the stomach. He was well aware that the time which had elapsed was too short to make any statement regarding the permanency of the good result obtained in this case.

RUPTURE OF THE GASTROHEPATIC OMENTUM

DR. N. W. GREEN presented a boy, eight years of age, who was run over by a light ice wagon when six. He was carried by the ambulance to the Reception Hospital, and from there he was admitted to the surgical service of the City Hospital. He repeatedly gave a definite history of the wheel of the wagon having passed up his left leg and across his abdomen. On admission he appeared alert and somewhat in shock, with no rise in temperature, and with slight quickening of the pulse rate. His leucocyte count was 15,000. Upon physical ex-

amination his abdominal muscles were moderately rigid. He had diffuse tenderness over the whole abdomen. There was indefinite dulness on percussion in both flanks. There was a point of ecchymosis on the right side on a level with the umbilicus. As he appeared to be suffering from peritoneal irritation, and as the ecchymosis was directly over the liver, it was thought advisable to open the abdomen. At operation the same afternoon bloody fluid escaped from the peritoneum. Oozing but no active bleeding was located in the torn gastrohepatic omentum (a one and a half inch rupture being present near the right hand border). No further injury to any viscus could be detected, but owing to the force exerted by the weight of the wagon it was feared that some injury to the gut might have been done, and so a tube and cigarette drain was inserted to the site of the laceration, the wound being then closed, except for this drain.

The same evening the patient vomited some thick brown fluid. The cigarette drain was removed the next day. Four days after operation there was a discharge of pus with a slightly greenish tinge. Ten days after operation the discharge had a suggestion of sourness in odor. On the thirteenth day the discharge was decidedly sour, with a distinct odor like stomach contents. Fourteen days after operation the discharge was very slight and the drainage opening was closing. Four weeks after operation the patient was discharged cured.

The patient was shown on account of the unusual nature of the injury.

Dr. A. V. Moschcowitz recalled the fact that a number of years ago he had presented before the Society a case which was absolutely identical with the one presented by Dr. Green. He did not feel warranted in operating upon the patient in the beginning, but finally the condition became such that he was compelled to operate. There was a quantity of blood in the abdomen. Careful search revealed only a small tear in the gastrohepatic omentum. The patient made a good recovery.

Dr. Frederic Kammerer recalled the case of a young boy, who had come under his observation some years ago in which, after injury, an internal hemorrhage occurred. At operation the entire abdomen was filled with blood. A most careful search failed to reveal the seat of the hemorrhage, which was, however, evidently located in the upper abdomen. The abdomen was closed and the patient recovered without further complications. The speaker thought he might have overlooked a rupture of the gastrohepatic omentum in this case, as the hemorrhage had ceased at the time of operation.

THE SURGICAL TREATMENT OF GASTROCOLOPTOSIS

Dr. John Douglas read a paper with the above title, for which see page 545.

Dr. Robert T. Morris thought it quite important, in dealing with cases of relaxed peritoneal supports, to understand that the visceroptosis represents stigmata which, with various other stigmata, make one perspective in a large picture. He generally practised all the principles prescribed for this condition of the stomach and colon, and had found that many of these patients get quite as well by other methods as by operation. In one group of these cases almost anything one might do for them would make them better. They liked to respond to treatment. The numerous methods of support which could be given without operaton were sometimes effective. Goldthwaite, of Boston, for example, used a support, and all his patients seemed to improve. Goldthwaite's support, Rose's belt, and all the other, however, had their objections. He had performed gastrorrhaphy, taking a tuck in the stomach; he had employed the Rovsing operation and all the others, and the result was that most of the patients had been benefited—because something had been done for them. There was, however, a second group of cases with very different effects—the toxic group. These patients suffer from intestinal toxæmia, having a condition which he had described as "cobwebs in the attic." Unless these cobwebs were separated the motility of the pylorus would be interfered with, and a long chain of secondary symptoms, familiar to all, would be inaugùrated. With the employment of sufficiently vigorous treatment,—massage, mountain climbing, climbing stairs, etc.,—these patients would be benefited just so long as they were prodded, so to speak. They were neurasthenics, however, and must be prodded.

Dr. William A. Downes considered the class of patients under discussion definitely ill. Many of them could not take prolonged rest, do mountain climbing, and resort to the other measures mentioned. Many of them were working men and women and must return to work as soon as possible. For that reason, operative relief of some sort was indicated, and if the operation suggested by Dr. Douglas was successful it was preferable to more radical procedures. However, the speaker had not been so fortunate in obtaining good results from the various fixation operations, and therefore had resorted to gastro-enterostomy with pyloric occlusion in eight cases. The pylorus was closed in five instances by means of a heavy Pagenstecher ligature, and in three instances a complete division with inversion was done. In one case,

which had been presented before this Society, vomiting recurred, but in the others the result had been extremely satisfactory. It was a radical operation, but so far there had been no complications and it seemed worthy of trial in selected cases. Dr. Downes presented lantern slides illustrating two of the cases before and after operation.

Dr. George Woolsey, recognizing the fact that something must be done for patients who cannot afford to undergo prolonged treatment, had employed, in several cases of this kind, the method proposed by Coffey. One patient, who was markedly neurasthenic, had not been benefited. The others were very much improved. He had never employed the Rovsing method to correct gastroptosis; but he had used it twice where he did gastro-enterostomy for a large, dilated stomach, with pyloric stenosis, to temporarily support the stomach and prevent traction on the suture line, at the stoma. The stomach was suspended temporarily by this method, using silkworm-gut suture, which was removed ten days later. One of these patients, a woman who had suffered for twenty years with "stomach trouble," wrote him one year after the operation, that she had had no trouble, and that she had gained much in weight. In none of the cases was peristalsis interfered with by the operation.

Dr. H. H. M. Lyle had employed the Coffey operation in three cases, and in each instance the patient was made worse.

Dr. W. B. Coley showed the following patients:

I. CANCER OF THE RIGHT TESTIS RECURRENT IN THE LEFT SUPRACLAVICULAR GLANDS AND LEFT LUNG

M. J. F., 28 years, dentist by occupation; family history good. No trauma. Personal history: Nothing worthy of note until September, 1912, when he first noticed a swelling in the right testis, which slowly increased in size; no pain. Three months later, removal was done by Dr. John Blue of Montgomery, Ala. The testis and cord were removed as high up as possible.

Microscopical examination: Small round-celled sarcoma. Patient remained well for about two years. In the beginning of November, 1914, he noticed a swelling of the left supraclavicular glands, which rapidly increased in size. November 15, removal by Dr. Moody, who found the growth so adherent to the subclavian vein that it was impossible to make a complete removal. Microscopical examination showed the second specimen to be the same type of sarcoma as the first one.

X-ray taken of chest showed several areas of apparent involve-

FIG. 5.—Enchondroma of tibia (lateral view).

FIG. 6.—Anteroposterior view.

ment. The patient had noticed slight enlargement of the anterior portion of the thorax on the left side.

Physical examination, December 28, 1914, showed absence of the right testicle; no retroperitoneal involvement. Examination of chest showed slight enlargement of anterior portion of left thorax; some dulness on percussion; no râles. Just above the left clavicle was a tumor the size of a hen's egg—or slightly larger—made up of enlarged glands, more or less fused together, and fairly movable; skin not adherent, but slightly purplish in color; deeper gland by the clavicle apparently involved.

Patient's general health good; weight, 136 pounds (perfectly normal). No cachexia. Slight hacking cough; no blood in sputum. Clinical diagnosis: Recurrent metastatic sarcoma of the testis. December 28, 1914, was referred to General Memorial Hospital for toxin treatment.

Pathological Report:—Recurrent tumor of supraclavicular region. Material consists of a large encapsulated soft mass as large as a hen's egg. Section shows a malignant tumor of large, clear, polyhedral cells, closely webbed together, but with clear fine borders, arranged in small and large groups, inclosed in hyaline, necrotic or fibrous tissue. Cells merge smoothly into supporting tissue. No pigment. Few myeloid giant cells. Some radially striated foreign bodies inclosed by cells. No diagnosis. Possibilities: (1) endothelioma; (2) melanoma; (3) metastatic carcinoma. A search for primary tumor is indicated. (By some mistake a copy of the clinical history was not sent to the pathologist.)

This case shows the extreme difficulty in classifying malignant tumors of the testis. The older tendency to regard them all as sarcomas has yielded to the more recent and increasing tendency to classify them all as carcinomas, or teratomas with carcinomatous degeneration. In view of the great difference of opinion among pathologists Dr. Coley believes it best to group all malignant tumors of the testis under a single head, "cancer." This has been done by Chevassu and others. Another important point brought out by this case is that in certain instances there is no indication for the formidable operation—strongly urged by Chevassu, France, and more recently by Hinman of Johns Hopkins—*i.e.*, the removal of the preaörtic glands as a routine measure in cases of sarcoma of the testicle.

II. ENCHONDROMA OF THE TIBIA WITH TRAUMATIC DETACHMENT

W. W., male, age 32 years, was referred to Dr. Coley on January 8, 1915, with the following history: Family history good. No history of specific disease or tuberculosis. No local trauma.

About 8 years ago noticed a small hard lump just under the left leg, a short distance below the popliteal space, apparently attached to the bone. This swelling gradually increased in size without causing any pain or disability. About a week before Dr. Coley saw him, he had a slight fall in which the leg was wrenched. The patient felt something snap, and had pain and increased swelling of the calf of the leg after the injury. He consulted Dr. Shaw, of Coshocton, Ohio. An X-ray photograph was taken of the leg, and the diagnosis of the radiologist was osteosarcoma (Figs. 5 and 6).

Physical examination at the time of Dr. Coley's first observation (January 8) a week after the injury, showed the left calf of the leg about twice the size of the right. A fluctuating smooth symmetrical tumor was found situated directly under the upper part of the muscles of the calf. On deep palpation there could be detected—in what seemed to be bottom of a cyst—a hard, movable, mass of bony or cartilaginous consistence. Dr. Coley's clinical diagnosis was enchondroma or osteoma, which had been broken off from its attachment to the base of the tibia by the recent trauma. Dr. Coley advised exploratory operation, and on January 20, under ether anæsthesia, he made an incision directly over the inner portion of the calf of the leg, and came down on what appeared to be a cyst with greatly thickened walls. In cutting through the latter, about 8–10 ounces of reddish serum were evacuated. The posterior wall of the cyst contained a tumor, made up chiefly of cartilage. The cyst wall together with the tumor was removed. Opposite the tumor, and about an inch away was found a sharp bony projection from the posterior surface of the tibia—apparently the proximal portion of the pedicle from which the tumor itself had been recently broken off. This was removed by rongeur forceps, and the wound closed with drainage.

The present specimen shows very clearly the conditions described. The cyst walls were doubtless formed by constant irritation, caused by the rubbing of the tumor against the muscle during the long period of formation. The gross specimen shows the tumor to be unquestionably an enchondroma. The report on the microscopical section has not yet been received.

Clinically it is a benign type of enchondroma; microscopically there is little difference between the pedunculated slow-growing enchondroma, which is practically benign, and the diffused form, which is most frequently seen in the ilium, and which is, clinically, a chondro-sarcoma of the femur with a high degree of malignancy.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting, January 4, 1915

The President, Dr. John H. Gibbon, in the Chair

CARCINOMA OF FLOOR OF MOUTH

Dr. Astley P. C. Ashhurst presented a man, aged fifty years, who over a year ago began to have trouble in the floor of the mouth, between the frænum and the symphysis. When first seen by Dr. Ashhurst in August last, there was present a foul odor, and the man was dizzy from weakness on standing. It seemed to be an inoperable case. On August 4, he injected eucaine into the lingual nerves and tried to divide them. Ten days later he gave him ether by the intrapharyngeal method and cauterized the mouth. Then the man gained seven pounds in two weeks. He was able to eat and sleep well, and went home for a holiday. Two weeks afterward, under intratracheal insufflation anæsthesia, he removed the glands on the left side of the neck, including the sternomastoid muscle, but leaving important nerves that could be saved. This shocked him very much and he lost ten pounds. Four weeks later he operated on the right side of the neck, in a similar manner. In the second operation he had to sacrifice the spinal accessory and hypoglossal nerves. At both operations on the neck the floor of the mouth was thoroughly cauterized from the neck wounds. There are now, more than three months after the last operation, no signs of carcinoma in the floor of the mouth. He has good use of the neck and head and eats and sleeps very well and can make himself understood in conversation, though the tongue is almost immovable. He has gained thirty-one pounds in weight.

The pathological report showed involvement of the glands of the upper part of the neck but not of the lower.

The interesting point in this case is the value of the cauterization of the floor of the mouth, with the cautery almost at a black heat, first from within the mouth, and subsequently from the neck wounds. The disease certainly has been arrested.

RECOVERED EMPYEMA

Dr. Nathaniel Ginsburg presented a man upon whom a partial rib resection for empyema of the thorax had been done at the Philadelphia Hospital, in February, 1914, the incision being located in the

midaxillary line, removing a portion of the rib. When first observed by Dr. Ginsburg, there was a foul profuse discharge from the drainage tract, with temperature, loss of weight and great prostration.

He injected bismuth paste into the sinus, and for a time marked cessation of the discharge resulted, but later the man grew rapidly worse and impending death seemed certain. A skiagraph showed what was interpreted by the radiologist as a large subphrenic collection of pus in the right pararenal area. After a careful exploration of the kidney area through a loin incision, no subphrenic collection of fluid was discovered. At a second operation, a week later, Dr. Ginsburg removed the ninth rib from the post-axillary line to the costochondral junction, and found that the picture of a subphrenic abscess proved to be a collection of decomposed bismuth paste which filled a long, isolated tract, extending anteriorly to the cartilage of the sternum. The reporter stated that he wished to emphasize, in reporting this case, that it is one of empyema in which the so-called posterior drainage to which Dr. Thomas has recently called attention, and which at an earlier date had been discussed by some of the French School of Surgeons, and also recommended by Kocher in selected cases, was not feasible. He believed this patient gives reason for believing that many cases of pyothorax cannot be so reached, but must be drained at the point of aspiration. From the beginning this man apparently had a pus cavity which never would have been touched by posterior incision. Free exposure of the whole cavity and healing from the bottom removed the trouble. The case is the only one of four old cases of empyema recently seen which finally recovered.

RUPTURE OF THE BICEPS

Dr. Emory G. Alexander read a paper with the above title, for which see page 608.

Dr. John H. Jopson exhibited a patient showing the results of an operation for rupture of the long head of the biceps muscle, who was one of two upon whom he had operated for rupture of the long tendon.

This patient was injured a year ago in an accident on a schooner. He was raising a sail and was caught by a rope, which wound around his arms in such a manner that the left arm was practically torn off and was later amputated a few inches below the shoulder. The right shoulder and upper arm were also injured. When Dr. Jopson saw him some months later, he exhibited the usual symptoms of rupture of the biceps muscle and, in addition to this, there was marked limitation of abduction and forward extension of the arm. He was operated on at this time and it was found that the long tendon had been torn about

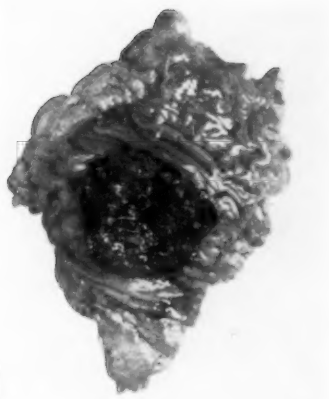

FIG. 1.—Proliferating epithelioma of the sigmoid.

3 cm. above the belly of the muscle and the two fragments were connected by a thin, flaccid strand of connective tissue. The tendon was plicated and sutured to the short head of the biceps. The result was satisfactory as regards the power of flexion of the arm, although there is still some depression above the belly of the muscle. The limitation of abduction and forward movement of the arm caused the patient to return for further treatment. The head of the humerus was then exposed through an anterior incision between the deltoid and pectoralis major muscles and the lesser tuberosity was found to have been fractured and was attached at a lower level than normal, while the head of the bone was above and in front of the glenoid cavity. The lesser tuberosity was chiselled off subperiosteally, which permitted the head of the bone to be brought down nearer its normal location, and the arm was dressed at a right angle to the body and kept in this position for several weeks. The patient now shows marked improvement in the movements which were formerly almost abolished, viz.: abduction and forward extension, although the head of the bone is still above its normal location. With treatment by massage and passive motions further improvement is probable.

The other patient was a man, aged sixty-eight, who, while attempting to catch a heavy bunch of bananas, was struck by it, the weight falling on his arm. In this case, operation showed that the tendon had been torn from the edge of the glenoid cavity. It was sutured to the common tendon of origin of the short head of the biceps and the coracobrachialis muscles through a second incision just below the coracoid process, the tendon being made taut before it was attached. He had not been able to trace this patient.

PROLIFERATING EPITHELIOMA OF THE SIGMOID

Dr. George G. Ross reported the history of a man aged seventy, who suffered some 20 years ago from various digestive disturbances and some nervous symptoms which he thinks were due to his habits of life. Under treatment he improved and remained fairly well until two or three years ago when he began to fail. About the same time his wife's serious illness caused considerable anxiety and stress. After the result in her case became apparently hopeless, he himself ran down rapidly and has continued so until now. Has lost about 70 pounds in the last year or year and a half. His color, however, remained fairly natural. He has lately had some intestinal symptoms which seemed to point to the sigmoid region or perhaps lower. He is habitually constipated and constantly takes laxatives. He has dis-

charged blood from time to time; sometimes several times a day. No particular local pain or soreness. On examination there is some hardness of the sigmoid region but no very definite indications of a mass. He is decidedly emaciated but not cachectic. Constant starvation diet may account for some of this. No renal symptoms of a definite kind. Urine shows as follows: Negative except for a heavy indican reaction; specific gravity 1022; a few casts. X-ray shows an incomplete obstruction of the sigmoid about the middle. This was best shown by X-ray of the bismuth injections from below. Blood count: Red blood-cells 4,520,000; white blood-cells 7,000; 79 per cent. polynuclears; 66 neutrophiles; 27 lymphocytes; 3 large mononuclears; 0 transitionals; 4 eosinophiles.

Operation (December 3, 1913): Left rectus incision. Hard mass in middle portion of sigmoid demonstrated. Outer layer of meso-sigmoid incised to mobilize the sigmoid. Bowel clamped to either side of tumor. Sigmoid cut through with actual cautery between clamps, proximal and distal to tumor, and five inches of sigmoid, containing the tumor (Fig. 1) removed. End-to-end anastomosis, proximal and distal end of sigmoid, using chromic gut for mucosa and muscular layer reinforced by linen suture for serosa. Anastomosis reinforced by epiploic appendages which were sewn over side of anastomosis with linen suture. Colon tube passed to point above anastomosis. Colon tube sewn to anus with one silkworm-gut suture. Wound closed in layers. Dry dressing.

The day following operation the patient developed a bronchitis without temperature. The rectal tube was removed on the third day and the patient had a formed stool. He subsequently showed abdominal distention, diminished urinary output, and finally died seven days after operation from uræmia.

ANNUAL ORATION: THE OPERATIVE TREATMENT OF ARTERIAL THROMBOSIS AND EMBOLISM

Dr. Francis T. Stewart delivered the annual oration, for which see page 519.

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